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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**THE POLITICAL ECONOMY
OF INFRASTRUCTURE INVESTMENT
IN LATIN AMERICA**

by

Noah J. Hassler

March 2018

Thesis Advisor:
Second Reader:

Robert Looney
Thomas Bruneau

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**THE POLITICAL ECONOMY OF INFRASTRUCTURE INVESTMENT IN
LATIN AMERICA**

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

What factors are responsible for varying levels of infrastructure investment and development across Latin America? Deficiencies in economic infrastructure—broadly classified into four main sectors: transportation, energy, telecommunications, and water and sanitation—have been a principal factor limiting economic growth, slowing development, and increasing inequality in Latin America. In this thesis, I examine how formal and informal political institutions affect economic policy and the actions of politicians to determine the degree of infrastructure investment and development in Brazil. My research indicates that despite above average investment levels, Brazil's relatively low infrastructure development stems from its degree of political and fiscal decentralization combined with an electoral system that promotes clientelistic networks, reducing the effectiveness and efficiency of investments. Though Brazil displays some geographic and cross-sector variation, a preliminary examination of Mexico and Chile supports the central role that institutions play in infrastructure investment and development across the region. Moreover, my combined analysis of these three cases suggests it is not simply the shape of institutions, but also the manner in which they evolve, that prove instrumental in determining a country's level of infrastructure development and the strategies by which it can improve.

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LIST OF ACRONYMS AND ABBREVIATIONS

BNDES	<i>Banco Nacional de Desenvolvimento Econômico e Social</i> (Brazilian Development Bank)
CAF	<i>Corporacion Andina de Fomento</i> (Development Bank of Latin America)
CESIS	Center for Excellence for Science and Innovation Studies
ECLAC	Economic Commission for Latin America and the Caribbean
EIU	Economist Intelligence Unit
FDI	Foreign Direct Investment
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
HDI	Human Development Index
IDB	Inter-American Development Bank
IMF	International Monetary Fund
LAC	Latin American and the Caribbean
LAC-6	Argentina, Brazil, Chile, Colombia, Mexico, and Peru
NBER	National Bureau of Economic Research
OECD	Organization for Economic Cooperation and Development
PAC	<i>Programa de Aceleração do Crescimento</i> (Growth Acceleration Program)
PPI	<i>Programa de Parcerias de Investimentos</i> (Investment Partnership Program)
PPP	Public-Private Partnership
PR	Proportional Representation
PRI	<i>Partido Revolucionario Institucional</i> (Institutional Revolutionary Party)
TELMEX	<i>Teléfonos de Mexico</i>
TFP	Total Factor Productivity
WEF	World Economic Forum

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I. INFRASTRUCTURE IN LATIN AMERICA

A. INTRODUCTION

What factors are responsible for varying levels of infrastructure investment and development across Latin America? Deficiencies in economic infrastructure—broadly classified into four main sectors: transportation, energy, telecommunications, and water and sanitation—have been a principal factor limiting economic growth, slowing development, and increasing inequality in Latin America.¹ In this thesis, I examine how the combined effects of institutions, policies, and individual discipline in three of Latin America's largest economies have led to varying levels of infrastructure development measured in terms of quality, quantity, and access. Following a comprehensive examination of Brazil's infrastructure investment and development trends across time and sector as well as in regional and global contexts, my analysis of the independent variables suggests that—despite what appear to be higher than average investment levels—Brazil's relatively low infrastructure quality, quantity, and access are the result of formal and informal political institutions. More specifically, Brazil's level of political and fiscal decentralization, personalistic-supporting electoral system, and clientelistic electoral markets that evolved during the transition to democracy, have all placed public and private infrastructure investments below what is necessary while simultaneously hindering their effectiveness and efficiency.

After applying those initial conclusions to a preliminary analysis of Mexico, I also find that the level the political and fiscal decentralization, established through the democratization process, emerges as fundamental in explaining infrastructure investment trends. However, Mexico's greater party authority and centralization may have shaped the incentives behind both public and private infrastructure investment, producing less investment than in Brazil but placing a greater emphasis on efficiency and effectiveness and resulting in higher degree of infrastructure development. In contrast, Chile presents a case where political decentralization during the democratic transition did not bring with it

¹ César Calderón and Luis Servén, "The Effects of Infrastructure Development on Growth and Income Distribution," *Policy Research Paper 3400* (Washington, DC: World Bank, 2005): 4.

strong calls for fiscal decentralization. Additionally, Chile's centralized political structure created to a high degree of managerial and technical capacity at the local level that—a when combined with the informal institutions established by political actors in an effort prevent a return to authoritarianism resulted in higher and more stable investments with a greater emphasis on effectiveness and efficiency—led to some of the highest levels of infrastructure quality, quantity, and access in the region. Taken together, not only do these three cases support the fundamental impact that formal and informal institutions have had on infrastructure investment and development, the driving forces behind their evolution may also be central to explaining the opportunities and challenges that certain institutions pose to infrastructure in general and to fiscal policies in particular. This, insight may prove critical for countries seeking to establish a strategy in order to address its main institutional challenges.

This chapter proceeds with a review of the literature related to the role infrastructure plays on a country's economic growth as well as recent trends in Latin America's infrastructure investment and development. It then proceeds to outline my hypothesis for the way that institutions, policies, and the leadership can affect infrastructure development. Finally, I define the scope of my research, select my cases for analysis, outline my data sources, and provide some definitions regarding measures of infrastructure quality, quantity, and access.

B. LITERATURE REVIEW

A consensus has emerged in academic literature that poor-quality and insufficient infrastructure has become an obstacle to economic growth, development, competitiveness, and equality in Latin America. Aschauer's influential study first established the empirical link between infrastructure investment and economic growth when he determined that the decline in the growth of Total Factor Productivity (TFP) in the United States from 1971 to 1985 was the result of a decrease in government spending on “core” infrastructure, including transportation, electrical and gas facilities, water

systems and sewers.² In less quantitative terms, Reyes and Sawyer build upon a basic model of economic growth developed by Robert Solow to analyze how a country's various factors of production all contribute to growth. They conclude that much of Latin America's economic problems come down to poor infrastructure, which "makes it difficult both for businesses to operate efficiently and for individuals to obtain maximum utility. In the former case, poor infrastructure reduces TFP and, by extension, economic growth and GDP per capita."³

While the roots of Latin America's underdeveloped infrastructure extend to its colonial past, events of the 1980s and 1990s have had the greatest impact on shaping the region's current infrastructure investment climate. Calderón and Servén identify two forces behind the retrenchment of the public sector's previously exclusive role in infrastructure investment during this period in Latin America.⁴ First, they state that the move to fiscal austerity following the macroeconomic and financial instability of the debt crisis and subsequent lack of foreign funding forced Latin American governments to implement significant cuts to infrastructure expenditures. Second, they assert that the debt crisis exposed the flaws of the economic model of state-led development, leading to a new paradigm in which private finance—through the free market—would now have a prominent place in various industrial and commercial sectors to include infrastructure. Overall, Calderón and Servén show that, following the substantial decrease in public infrastructure spending in the late 1980s, private investment was ultimately unable to fill make up the difference. As a result, by 2006, total infrastructure investment in the six largest Latin American economies averaged slightly less than 2 percent of their total GDP; around half of the level prior to the debt crisis (refer to Figure 1).⁵

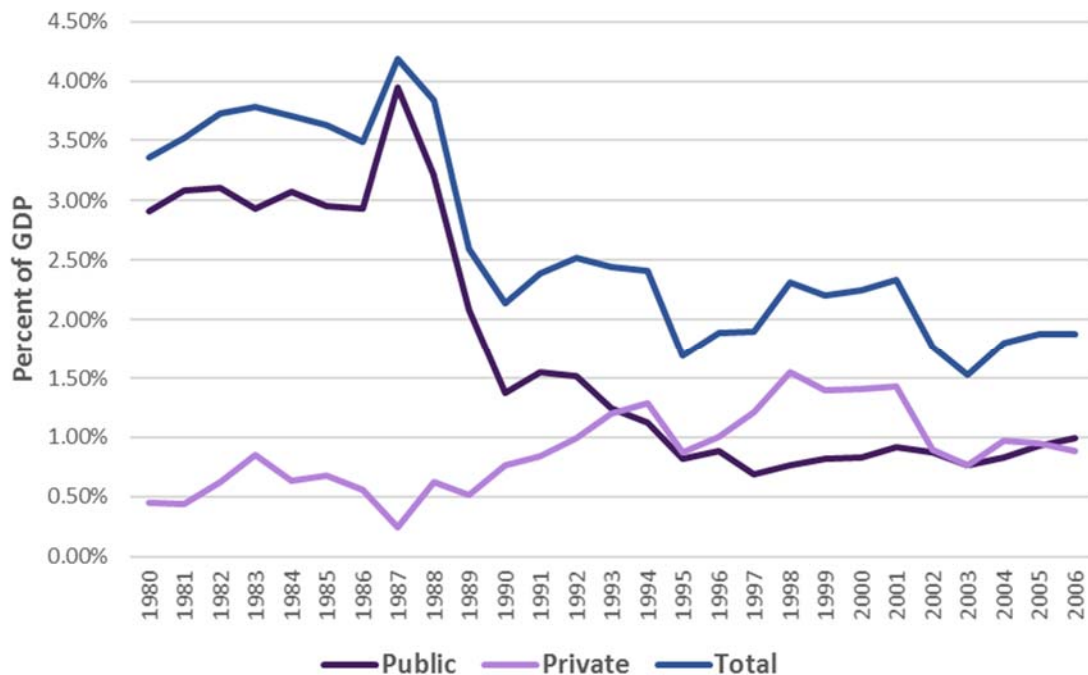
² David Aschauer, "Is Public Expenditure Productive?," *Journal of Monetary Economics* 23, no. 2 (March 1989): 193–195.

³ Javier A. Reyes and W. Charles Sawyer, *Latin American Economic Development* (New York: Routledge, 2016), 121.

⁴ César Calderón and Luis Servén, "Infrastructure in Latin America," Policy Research Paper 5317 (Washington, DC: World Bank, 2010): 21–22.

⁵ *Ibid.*, 23.

Figure 1. LAC-6: Infrastructure Investment, 1980–2006⁶



GDP-weighted averages. Includes investments in telecommunications, power generation, land transportation (roads and railways), and water and sanitation.

In a recent study to determine the level of infrastructure investment required by the developing world, Ruiz-Núñez and Wei calculate that, as a region, Latin America needs investments totaling 1.9 percent of GDP between 2014 and 2020 solely to maintain current infrastructure stocks.⁷ Additionally, they determine that in order to achieve a forecasted growth rate of 3.32 percent over that same period, Latin America requires an additional investment of 1.7 percent of GDP to acquire new infrastructure stock.⁸ Moreover, they calculate that as of 2011, Latin America was only investing 1.2 percent of GDP, leaving a funding gap of 2.4 percent of GDP in order to meet growth targets;

⁶ Adapted from Calderón and Servén, “Infrastructure in Latin America,” 23.

⁷ Fernanda Ruiz-Núñez and Zichao Wei, “Infrastructure Investment Demands in Emerging Markets and Developing Economies,” *Policy Research Paper 7414* (Washington, DC: World Bank, 2015): 9–10.

⁸ *Ibid.*, 7, 9–10.

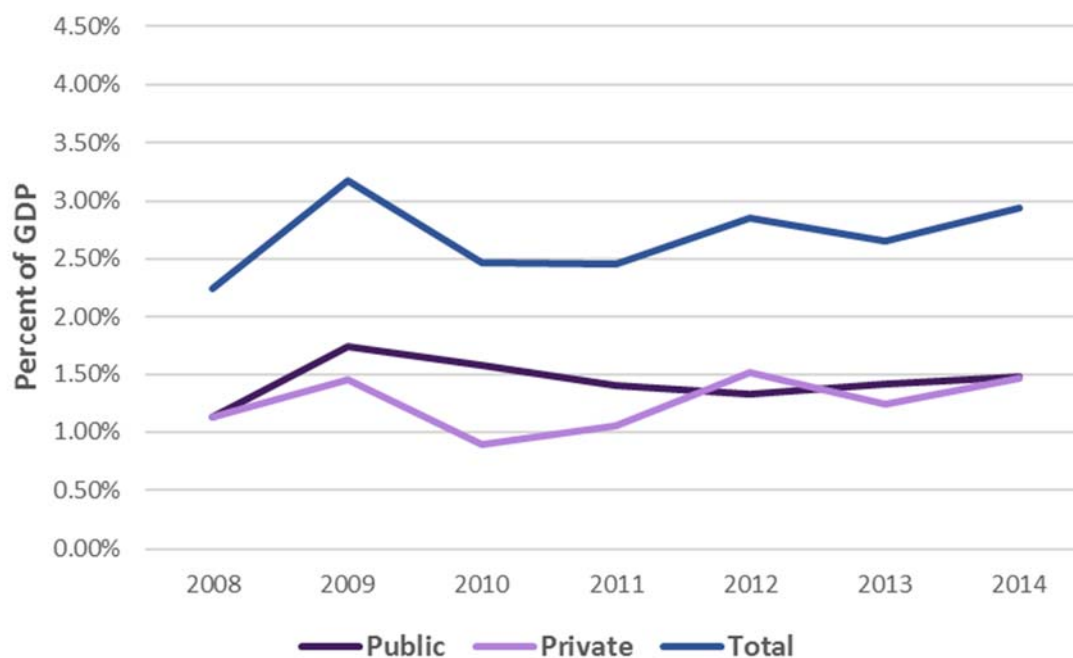
representing what they claim is a “lower bound estimate” based on data limitations and a restricted focus on particular infrastructure sectors.⁹

Similarly, the Development Bank of Latin America (*Corporación Andina de Fomento*, or CAF), currently estimates that Latin America requires an additional 3 percent of GDP in order to close the infrastructure gap between the region and advanced economies.¹⁰ Though, my analysis of recent figures—available through the combined efforts of the United Nations Economic Commission for Latin American and the Caribbean (ECLAC), CAF, and the Inter-American Development Bank (IDB)—show that Latin America’s infrastructure investment outlook may have begun to slightly improve at the beginning of the decade (refer to Figure 2). However, World Economic Forum (WEF) indicators of relative infrastructure quality for LAC-6 economies do not generally correlate to the increased investment levels over this time period (refer to Figure 3).

⁹ Ibid., 15.

¹⁰ Development Bank of Latin America, “How to Close the Infrastructure Gap in Latin America,” last modified February 18, 2016, <https://www.caf.com/en/currently/news/2016/02/how-to-close-the-infrastructure-gap-in-latin-america/>.

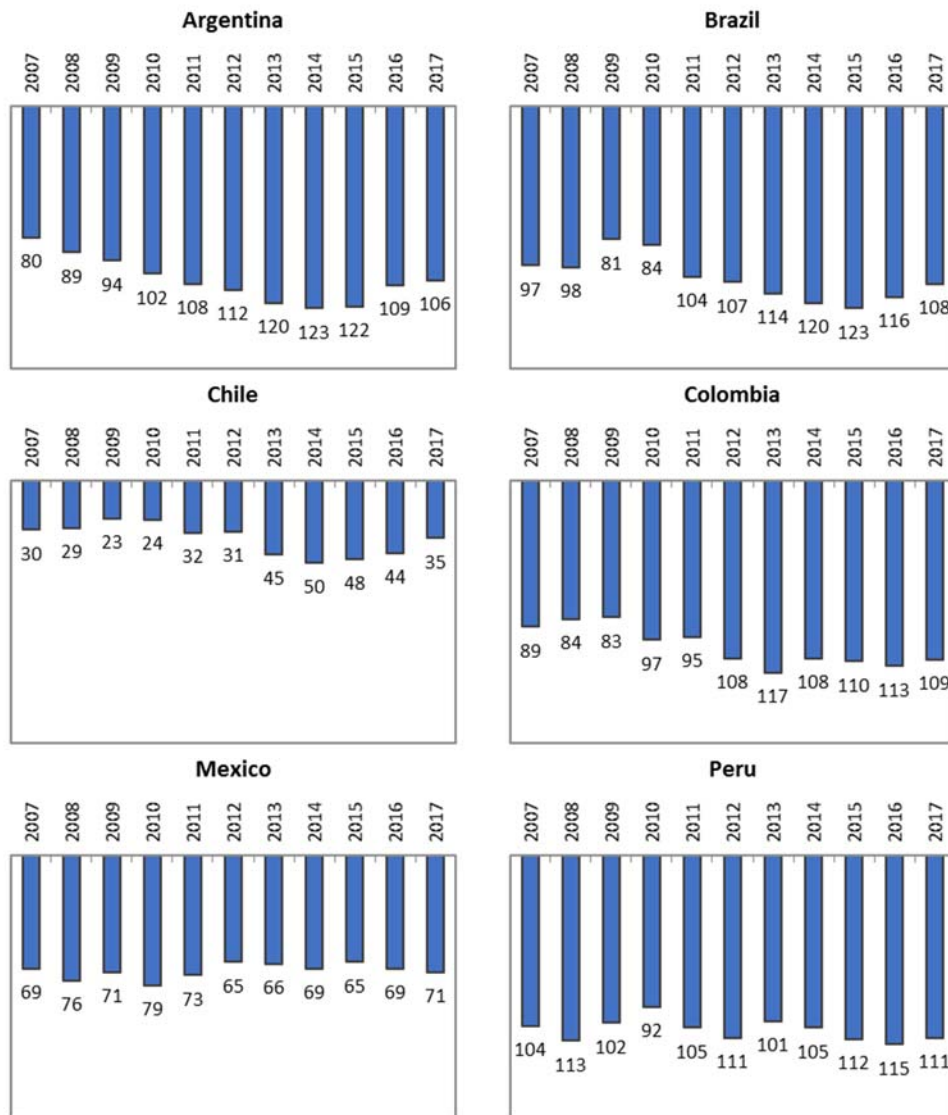
Figure 2. LAC-6: Infrastructure Investment, 2008–2014¹¹



GDP-weighted averages. Includes investments in telecommunications, energy (electricity and gas), transportation (roads, railways, air transport, fluvial transport and seaports), and water (water and sanitation, flood defenses, and irrigation).

¹¹ Adapted from ECLAC, CAF and IDB, Infralatam Database, accessed October 18, 2017, <http://database.infralatam.info/>.

Figure 3. LAC-6: WEF Quality of Overall Infrastructure, 2007–2017 Rankings¹²



Lower numbers indicate better ranking.

Regardless of the source or approach, it is clear that Latin America requires significant, additional investment in infrastructure to promote economic growth, increase development, enhance competitiveness and combat inequality. This thesis seeks to examine and identify those factors that have been successful at both increasing

¹² Adapted from WEF GCI Dataset 2006–2017.

investment and improving infrastructure across dimensions of quality, quantity, and access in order to aid future infrastructure investment strategies.

A review of literature related to infrastructure investment across developing countries highlights the distinct but complicated relationship between various institutions, policies, and the international and domestic factors that affect this topic. There is a clear need to establish and capitalize on the ideal conditions for both public and private investment in infrastructure. At the same time, a country's political institutions and pre-established economic policies, combined with weak leadership and discipline among individual politicians may constrain a government's ability to increase infrastructure investment—either directly through public funds or indirectly through private funds—and ensure that what investment is available is used effectively (that is, spent on the right project at the place at the right time to maximize utility) and efficiently (getting the most value for the money and return on investment).

As I mentioned previously, in the 1980s and 1990s, public infrastructure investment declined in the aftermath of the debt crisis. Calderón and Servén observe that public investment in general, and in infrastructure in particular, account for only a relatively small portion of both GDP and public expenditures but make up the majority of fiscal deficit reduction in times of economic crisis.¹³ At the same time Latin American governments were curbing public investment, they were expanding public consumption, highlighting an anti-investment bias characteristic of fiscal consolidation and the fact that, “investment is the most volatile of all public spending items.”¹⁴ This underscores two important phenomena related to public investment in times of fiscal constraints. First, from the political perspective, it is less contentious for politicians and governments to decrease or eliminate public investment and cancel infrastructure projects than to reduce consumption by cutting public sector wages or pensions.¹⁵ Second, as Easterly, Irwin, and Servén suggest, in misguided efforts to solve immediate liquidity issues by cutting short-term expenditures, governments not only decrease public consumption, but public

¹³ Calderón and Servén, “Infrastructure in Latin America,” 25–26.

¹⁴ *Ibid.*, 25–26.

¹⁵ *Ibid.*, 26.

investment as well, reducing assets that support to long-term growth and lead to future solvency.¹⁶

A situation where governments indiscriminately lump cuts in investment with cuts in consumption has the potential to spiral out of control. For example, Easterly, Irwin, and Servén demonstrate that regardless of the motivations, when fiscal adjustments ineffectually target growth-producing investments, they can create a “vicious circle, in which the subsequent deterioration of future revenue forces further investment cuts, leading to yet further deterioration, further investment cuts, and so on ad infinitum.”¹⁷ Alternatively, Ferreira and Araújo provide support to the corresponding phenomenon of a virtuous circle through a simulation where they illustrate that investment in infrastructure in Brazil can generate enough revenue through increased tax collection to cover the initial debt, effectively paying for itself over the long-term.¹⁸ As a possible solution, Mintz and Smart suggest that governments adopt a modified “golden rule” approach to capital expenditures, relaxing fiscal constraints to allow for a limited amount of debt in relation to GDP to finance “capital projects that generate commercial or self-liquidating assets, or which will generate revenues from user fees or other taxes that will ultimately recoup initial outlays.”¹⁹ Regardless of the exact solution, it is a clear problem that weak policies combined with poor discipline can make overcoming the anti-investment bias of fiscal consolidation during an economic downturn nearly impossible.

However, recent trends in the region provide a glimmer of hope; albeit one that may be slowly fading. The International Monetary Fund (IMF) notes that the “commodity supercycle” of the 2000s led to an increase in public investment as revenue

¹⁶ William Easterly, Timothy Irwin, and Luis Servén, “Walking up the Down Escalator: Public Investment and Fiscal Stability,” *Policy Research Working Paper 4158* (Washington, DC: World Bank, 2007): 7.

¹⁷ Ibid., 30.

¹⁸ Pedro Cavalcanti Ferreira and Carlos Hamilton Vasconcelos Araújo, “Growth and Fiscal Effects of Infrastructure Investment in Brazil,” in *Fiscal Policy, Stabilization and Growth*, ed. Guillermo E. Perry, Luis Servén, and Rodrigo Suescún, (Washington, DC: World Bank, 2008), 318–340.

¹⁹ Jack M. Mintz and Michael Smart, “Incentives for Public Investment under Fiscal Rules,” *Policy Research Working Paper 3860* (Washington, DC: World Bank, 2006): 25–26.

grew and finances strengthened.²⁰ Furthermore, the IMF reports that following the 2008 recession, many commodity-exporting Latin American countries were able to weather a decline in revenue without resorting to cutting investment leading to increases in overall infrastructure quantity and access.²¹ Likewise, Carranza, Daude, and Melguizo explain that, thanks to inflation-targeting regimes in many Latin American countries, as the financial crisis progressed, policy makers in the region “could boast significant fiscal stimulus packages while keeping country risk in check. These solid balances stood in stark contrast to the region’s historic performance, in which fiscal fragility had been at the root of protracted crises, including the dramatic debt crisis of the 1980s.”²² Given fiscal policies that support short-term growth (through the accurate timing of adjustments) and medium-term development (through the proper balance of taxes and expenditures), Carranza, Daude, and Melguizo state, “fiscal consolidation and public infrastructure investment could be complements, rather than substitutes.”²³

Unfortunately, the IMF reports that although infrastructure quantity and access may have increased, overall quality in each sector declined, indicating that Latin America may have invested in infrastructure that they were unable to maintain effectively.²⁴ What’s more is that those fiscal buffers have recently eroded, resulting in the potential for a similar pattern of anti-investment bias to develop in the years ahead.²⁵ In fact, Ocampo claims that although the region as a whole benefited greatly from the favorable external conditions of the commodity boom, it “not only spent all those gains, it ran a current account deficit. This means that the region in fact *overspent* the commodity boom.”²⁶ While external conditions supported increased public investment in infrastructure and

²⁰ International Monetary Fund, *Regional Economic Outlook: Western Hemisphere* (Washington, DC: IMF, 2016): 84.

²¹ *Ibid.*, 80–81.

²² Luis Carranza, Christian Daude, and Angel Melguizo, “Public Infrastructure Investment and Fiscal Sustainability in Latin America: Incompatible Goals?,” *Journal of Economic Studies* 41, no. 1 (2014): 30.

²³ *Ibid.*, 30–31.

²⁴ International Monetary Fund, *Regional Economic Outlook*, 80.

²⁵ *Ibid.*, 84.

²⁶ José Antonio Ocampo, “Uncertain Times,” *Finance & Development* 52, no. 3 (September 2015): 9. Italics are Ocampo’s.

robust policies helped Latin America weather the 2008–2009 crisis, addition public consumption and current account deficits mean that, with the end of the commodity boom, additional fiscal consolidation may be in the near future for much of the region and it will likely become increasingly difficult for these countries to maintain, let alone expand, their infrastructure stock.

This uncertain outlook on the availability of public funds potentially has an added consequence due to what the literature suggests may be a complementary relationship between public and private investment in infrastructure. Calderón and Servén note that Chile and Colombia—the two countries in their study that maintained the highest levels of public investment through 2006—attracted the highest levels of private investment; while Mexico and Peru displayed the lowest levels of public investment and, correspondingly received the lowest levels of private investment.²⁷ Cavallo and Daude highlight a more complex relationship between public and private investment in developing countries, arriving at a slightly different conclusion. They also reason that public investment theoretically has the potential to “crowd-in” private investments by increasing the marginal productivity of private capital.²⁸ However, the empirical evidence from their sample of developing countries demonstrates that weak institutions, high levels of corruption, insufficient international economic integration, and financing constraints can all distort the efficiency of public investments, negating any complementary benefits and actually “crowding out” private investment. The take-away is not that governments should avoid infrastructure investments in an institutionally weak environment because of its “crowding out” effect on private investment; instead, governments must strengthen institutions and establish policies to establish and capitalize on this complementary relationship.

Regardless of the exact reasons reducing private investment in infrastructure, the consequences extend beyond limiting an additional source of capital. The Development Bank of Latin America succinctly summarizes that more than simply representing

²⁷ Calderón and Servén, “Infrastructure in Latin America,” 24.

²⁸ Eduardo Cavallo and Cristian Daude, “Public Investment in Developing Countries: A Blessing or a Curse?,” *Journal of Comparative Economics* 39 (2011): 66.

additional investment funds, private participation in infrastructure can “incorporate the private sector’s technical and managerial knowledge, contributing value added and greater technical efficiency.”²⁹ Moreover, Khan and Reinhart provide empirical data from a broad sample of developing countries, confirming that the direct impact of private investment on a country’s long-term economic growth outperforms public investment.³⁰ They conclude that governments should, therefore, strive to create conditions favorable to private investment that “range from the most general—establishing a stable macroeconomic environment, provision of adequate legal and institutional arrangements for the protection of private property—to more specific ones, such as adequate access to credit and to imported inputs by private investors.”³¹

However, the literature also investigates some potentially negative consequences of private participation in infrastructure. Specifically, Andrés et al. note that private participation in utilities (electricity, gas, telecommunications, and water) may reduce employment and wages through cutbacks and efficiencies over state-run enterprises, increase prices when rates were previously held artificially low for political reasons, and limit expansion of services to smaller population centers and economically depressed areas that may lack clear commercial incentives.³² Additionally, Calderón and Servén caution that, when governments seek private participation solely for fiscal considerations and not for increased efficiency, they often provide investors with generous financial guarantees such as minimum revenue and long-term purchase obligations along with access to contract renegotiations.³³ Not only does this essentially shift the risk away from private investors and leave governments with the same liabilities had they directly

²⁹ Development Bank of Latin America, “Public-Private Alliances, Vital for the Development of Latin America,” Last modified December 1, 2015, <https://www.caf.com/en/currently/news/2015/12/public-private-alliances-vital-for-the-development-of-latin-america/>.

³⁰ Mohsin S. Khan and Carmen M. Reinhart, “Private Investment and Economic Growth in Developing Countries,” *World Development* 18, no. 1 (1990): 25.

³¹ Ibid.

³² Luis A. Andrés, J. Luis Guasch, Thomas Haven, and Vivien Foster, *The Impact of Private Sector Participation in Infrastructure: Lights Shadows and the Road Ahead* (Washington, DC: World Bank, 2008): 44–46.

³³ Calderón and Servén, “Infrastructure in Latin America,” 31–33.

undertaken the project themselves, it also allows for a significant portion of the costs associated with projects to evade budgetary accounting procedures and go unnoticed.³⁴

Fortunately, with the right efforts, governments may be able to avoid or mitigate many of those negative consequences. While McKenzie et al. find that the privatization of utilities in Latin America through the early 2000s did result in employment contractions in some sectors, they also determined that job losses were small relative to the aggregate labor force and tended to recover over the long-term.³⁵ Additionally, their research shows no clear pattern regarding privatization's effects on prices: they decreased in the majority of cases and, when they rose, they corresponded to improvements in quality and increased access to services as well. Moreover, McKenzie et al. highlight that privatization resulted in favorable fiscal and social effects as well since the privatization process eliminated subsidies used to fund state-run enterprises that were operating at a loss while, at the same time, creating profitable private enterprises that added valuable tax revenues, allowing governments to shift surplus funds toward increased social spending.³⁶ To mitigate any negative outcomes, Andrés et al. suggest that governments and policy makers first prioritize their objectives—whether it is to retain workers, or to increase efficiency, quality, and access—in order to determine if privatization will produce the desired outcome.³⁷ Carranza, Daude, and Melguizo encourage private investment in sectors and activities where they add “value and efficiency relative to the public sector,” but warn not to “create artificial fiscal space to increase infrastructure investment.”³⁸ Finally, Calderón and Servén recommend that governments strengthen regulatory frameworks, supervision, and contract agreements, and increase transparency in the privatization process to avoid past problems and fueling popular discontent.³⁹

³⁴ Ibid., 31.

³⁵ David McKenzie, Dilip Mookherjee, Gonzalo Castañeda, and Jaime Saavedra, “The Distributive Impact of Privatization in Latin America: Evidence from Four Countries,” *Economía* 3, no. 2 (Spring 2003): 212–213.

³⁶ Ibid., 213.

³⁷ Andrés et al. 228–229.

³⁸ Carranza, Daude, and Melguizo, 36–37.

³⁹ Calderón and Servén, “Infrastructure in Latin America,” 34–37.

In light of this, recent trends of infrastructure investment and development are improving in Latin America. The World Bank reports that—with the exception of Brazil (with its current economic uncertainty and the end of the boom of the World Cup and Olympics)—private investment in the region’s infrastructure increased 37 percent from 2014 to 2015 with Colombia standing out as the top market.⁴⁰ Commitments were well above their 10-year averages in all measured sectors (energy, transport, and water), with transportation projects receiving the greatest amount of investment.⁴¹ In terms of quality and quantity, the IMF calculates that, on average, Latin America’s infrastructure has been steadily improving and compares favorably with peers in other emerging markets although it continues to lag behind emerging Asia as well as advanced economies.⁴² With end of the commodity boom beginning to affect the region and plenty of room for improvement left, Latin America continues to require significant infrastructure investment to support economic growth, increase development, raise competitiveness, and reduce inequality.

C. HYPOTHESIS

While external economic factors have unquestionably had an effect on the overall economic growth and development of every Latin American country, three distinct but related variables emerge from the literature that profoundly shape the climate of infrastructure investment in the region: institutions, economic policies, and individual leaders’ discipline. Hypothetically, the countries that maintain effective investment-supporting institutions, implement appropriate economic policies, and place their trust in individuals with the capacity and willingness to make prudent but sometimes unpopular choices, should not only increase public and private infrastructure investment through good times and bad; the effective and efficient use of their resources should be visible through measured improvements across their infrastructure’s quality, quantity and access.

⁴⁰ World Bank, *2015 Latin America and the Caribbean (LAC) PPI Update* (Washington, DC: World Bank, 2016): 1.

⁴¹ *Ibid.*, 2–3.

⁴² International Monetary Fund, *Regional Economic Outlook*, 79.

Institutional type and quality perhaps form the foundation of any successful public or private investments. Broadly speaking, Hausmann identifies four challenges of public institutions that result in fiscal symptoms: aggregation of individual preferences, coordinating the use of common but limited resources, individual agency, and commitment or a long-term outlook.⁴³ He argues that these policy challenges stem from the combined effects of a country's political institutions, namely the centralization of power and authority in a country (the level at which revenue is collected and spending or investment decisions are made, whether at the national, state, or local level) and the electoral system and how it influences the number of political parties as well as their level of discipline.⁴⁴

More directly related to infrastructure, Cavallo and Daude explain, "Weak institutions distort the effectiveness of public investments, such that in an economy with high levels of corruption and rent-seeking, each dollar invested by the public sector produces less public services compared to an economy with good institutions."⁴⁵ Additionally, much of the literature points to the failure of deficient institutions to identify and prioritize critical requirements in appropriate sectors, provide sufficient oversight and monitoring, or successfully design and renegotiate contracts.⁴⁶ Furthermore, without effective property rights or the rule of law, governments will find it increasingly difficult to attract private or foreign investment because of the uncertainties surrounding risks and returns.⁴⁷ Therefore, strong institutions should not only be able to support and maintain high levels of both public and private investment, they should be able to effectively and efficiently allocate resources to the right projects in the right sectors at the right time to improve infrastructure across all dimensions.

⁴³ Ricardo Hausmann, "Fiscal Institutions for Decentralising Democracies: Which Way to Go?," in *Democracy, Decentralisation and Deficits in Latin America*, ed. Kiichiro Fukasaku and Ricardo Hausmann (Paris, France: IDB/OECD, 1998), 14–18.

⁴⁴ Ibid., 18–20.

⁴⁵ Cavallo and Daude, 66.

⁴⁶ For examples, see Carranza, Daude, and Melguizo, 35–37; and Calderón and Servén, "Infrastructure in Latin America," 33–37.

⁴⁷ Reyes and Sawyer, 124.

Upon initial examination of certain policy indicators, regional trends emerge. Hausmann highlights the challenge that Latin America faced at the end of the 1990s: suffering from a history of debt along with high inflation and extreme volatility, procyclical fiscal policies and electoral budget cycles were prevalent.⁴⁸ More recently, however, Carranza, Daude, and Melguizo make clear that, in the context of the 2008–2009 crisis, Latin America emerged with robust macroeconomic health due in large part to three things: proper fiscal policies that directed spending while controlling inflation; the effective use of monetary policy to manage interest and exchange rates; and maintaining openness to international trade and integration into global capital markets.⁴⁹ Effective and consistent policies should, therefore, be able to attract foreign and domestic investment while promoting private participation in infrastructure. Additionally, Cavallo and Daude argue that governments must balance the economic benefits of such policies against potential social costs to ensure that their decisions have the intended outcomes.⁵⁰ If done properly, governments should not only see higher and less volatile levels of public and private infrastructure investment, but increasing quality and access as well, even during times of fiscal consolidation.

Moreover, as individual politicians work within the system of opportunities and constraints, shaped by their country's institutions and influenced by domestic and international factors, they must choose and ultimately implement the appropriate policies to support healthy macroeconomic and social environments. Hausmann asserts that rewards and punishments—supported by government structures and political processes, but also enforced by a free press and effective judiciary—may compel individual agents to be honest and transparent.⁵¹ On the other hand, formal and informal institutions that promote a greater degree of agency may allow for an executive who chooses “too large a deficit because it wants to win elections, because it discounts the future too heavily, or

⁴⁸ Hausmann, 22.

⁴⁹ Carranza, Daude, and Melguizo, 30.

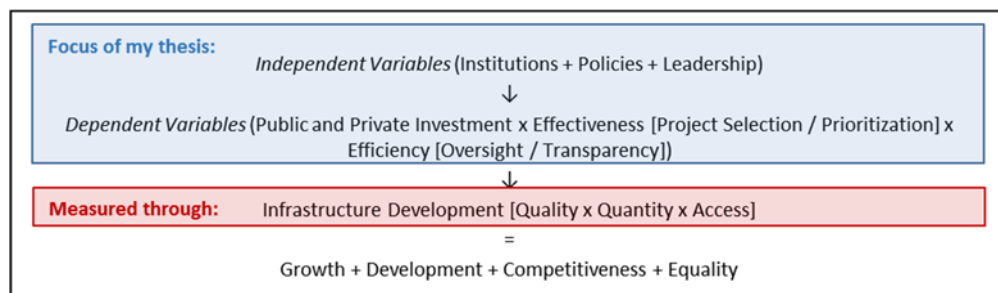
⁵⁰ Cavallo and Daude, 70.

⁵¹ Hausmann, 17.

because it derives private gains from it.”⁵² Additionally, Calderón and Servén identify that without strong resolve or commitment, the chances of governments abandoning their policies—either for short-term gains or in times of crisis—increase dramatically.⁵³ With that in mind, institutions susceptible to agency problems and governments led by individuals who lack capacity, commitment, or discipline may tend towards more volatile investment levels, corresponding to either business or electoral cycles, and displaying higher levels of corruption or waste, ultimately underperforming their competitors and neighbors in terms of overall infrastructure investment and development.

Taken together, the combined effects of robust and supportive institutions, proper policies, and disciplined leaders should facilitate governments in maintaining higher levels of public infrastructure investment, reinforcing the crowding-in effect that public funds can have on private investment, avoiding the anti-investment bias during times of fiscal consolidation, all while maintaining sufficient prioritization and oversight to ensure the effective and efficient use of resources. In turn, this will provide more access to higher quality infrastructure services, capitalize on the future growth potential of infrastructure, increase development and competitiveness, all while freeing up additional resources to support programs that promote higher levels of equality (refer to Figure 4).

Figure 4. Hypothetical Relationship between Independent and Dependent Variables in Infrastructure Development



⁵² Ibid., 24.

⁵³ Calderón and Servén, “Infrastructure in Latin America,” 25–26.

D. RESEARCH DESIGN AND OVERVIEW

1. Scope

To examine the validity of my hypothesis, I provide a comprehensive examination of Brazil's infrastructure investment and development trends (as measured through varying indicators of quality, quantity and access) across time and sector, and in both regional and global contexts. My analysis then proceeds along the lines of my independent variables (institutions, policy, and discipline) to determine their relative effect on the level of Brazil's infrastructure investment as well as its effectiveness and efficiency. After arriving at some initial conclusions in identifying those factors most influential to infrastructure investment in Brazil, I conduct a preliminary analysis of Mexico and Chile to broaden the scope of my research, substantiate my conclusions, and provide potential avenues for further research.

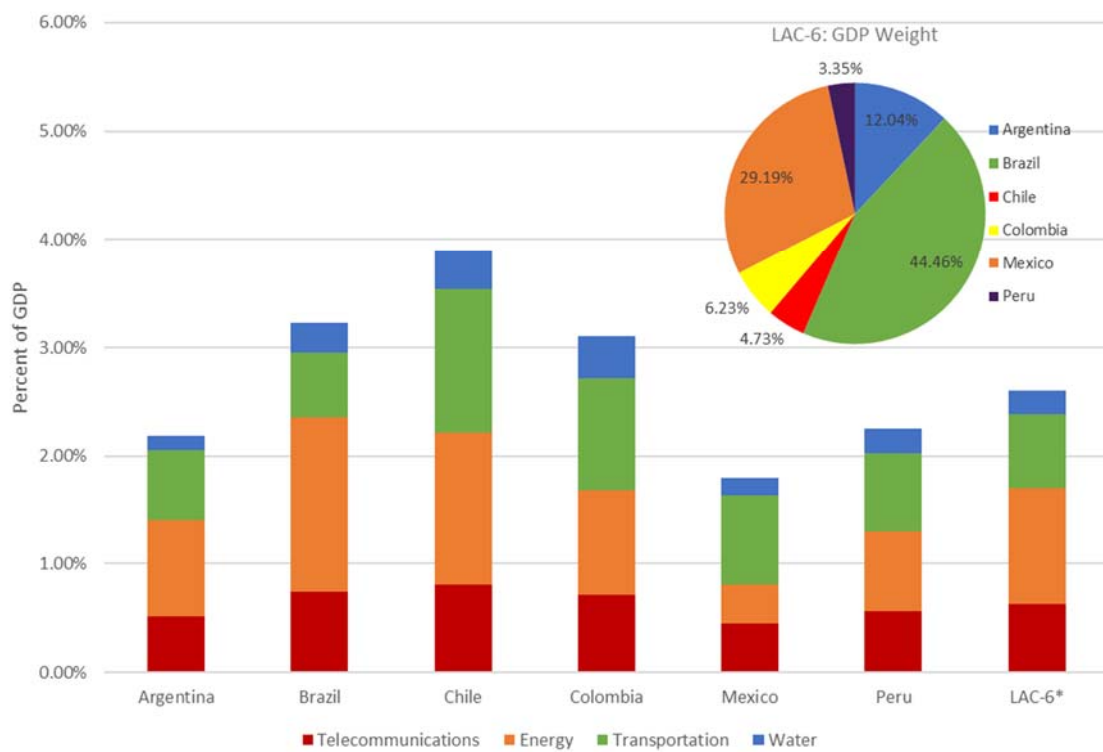
2. Analysis and Case Selection

I arrived at my case selection via a compilation of indicators that I found relevant to the topic. First, I compiled World Bank and Infralatam infrastructure investment data spanning from 1980 to 2014 for the six largest economies in Latin America (LAC-6: Argentina, Brazil, Chile, Colombia, Mexico and Peru—which combined represent 79 percent of the region's 2016 GDP) into Figure 5. Additionally, I placed the most recent WEF results for Quality of Overall Infrastructure for LAC-6 into a regional context in Figure 6. Finally, I constructed Table 1, which contains values corresponding to recent indicators that I find relative to the variables in my hypothesis from the six selected countries.

While Figure 5 presents a very broad overview of relative investment levels and relative economic size for LAC-6, two details initially emerge. First, Brazil and Mexico are clearly the leaders when it comes to the size of their economies—representing a combined total of over 73 percent of the group's GDP over the 1980–2014 period—while Peru, Chile and Colombia rank as the smallest economies with Argentina rounding out the middle. Second, Chile shows the highest average level of infrastructure investment over the period at 3.90 percent of GDP, followed by Brazil at 3.22, and Mexico and

Argentina representing the lower-end at 1.80 and 2.19 percent, respectively. Of note, when compared to the 2017 infrastructure quality rankings in Figure 6, Chile’s higher investment levels appear to have directly translated to higher infrastructure quality whereas Mexico—with group’s lowest average annual infrastructure investment levels—paradoxically ranks second among the LAC-6 countries and in the top third of the regional countries surveyed.

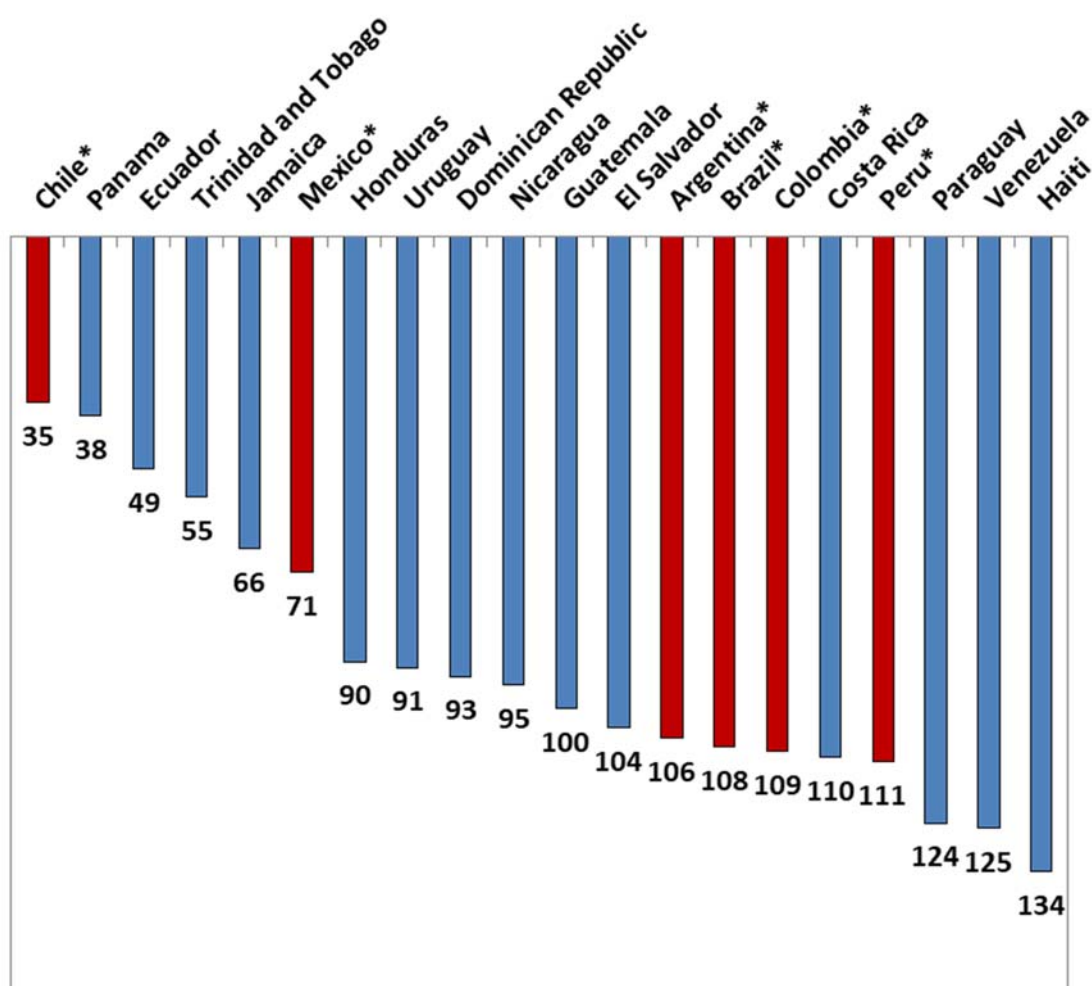
Figure 5. LAC-6: Infrastructure Investment Averages, 1980–2014⁵⁴



*GDP Weighted Average; 2007 data not available.

⁵⁴ Adapted from Calderón and Servén, “Infrastructure in Latin America,” ECLAC, CAF and IDB, Infralatam Database, accessed October 18, 2017, <http://database.infralatam.info/>; and World Bank World Development Indicators, accessed October 20, 2017, <http://data.worldbank.org/>.

Figure 6. LAC-6: WEF Quality of Overall Infrastructure in Regional Context, 2017⁵⁵



1 = Best, 137 = Worst. LAC-6 countries in red.

Added to the most recent indicators of institutions, investment, infrastructure, growth, development, competitiveness, and equality shown in Table 1, further patterns emerge. Chile receives high marks across the majority of indicators, displaying promise to investigate as a potential best-case and benchmark in the region; possibly representing the positive impact that institutions, discipline and policies have on not only maintaining high levels of investment, but turning that investment into more growth and development

⁵⁵ Adapted from WEF GCI Dataset 2006–2017.

through higher quality infrastructure. On the other hand, Brazil's enormous economy and higher levels of investment have unfortunately resulted in weaker growth and infrastructure quality; warranting investigation as a case in which institutions, discipline, and policies have combined to negatively impact infrastructure development. Contrasting the Chile and Brazil cases, Mexico's investment levels and institutions rank at or near the bottom of the group, however its infrastructure quality rating is second only to Chile, presenting an interesting puzzle potentially counter to my hypothesis where infrastructure development has proceeded despite the possibly lower investment and the possible, negative effects of poor-quality institutions. Of the remaining countries, initial evidence shows a limited availability and questionable quality of data for Argentina. Additionally, while Colombia and Peru represent somewhat similar cases, little jumps out as particularly significant in the regional context. Therefore, Brazil, Chile, and Mexico present the most diverse and promising initial case studies while representing 59 percent of Latin America's 2016 aggregate GDP.

Table 1. LAC-6: Relevant Indicators⁵⁶

		Argentina	Brazil	Chile	Colombia	Mexico	Peru	
Institutions	2017 WEF Institutions (Rank / 137)	113	109	35	117	123	116	
	2016 Corruption Perceptions Index (Rank / 176)	95	79	24	90	123	101	
Investment	Average Infrastructure Investment, 1980–2014 (percent of GDP)	2.19	3.22	3.90	3.11	1.80	2.25	
	Total Investment in PPP since 1990 (US\$ million)	48,057	329,932	29,428	33,181	67,576	27,948	
	2016 FDI, Net Inflows (percent of GDP)	2.01*	4.39	4.94	4.81	2.56	4.13*	*2015 data
Infrastructure	2017 WEF Quality of Overall Infrastructure (Rank / 137)	106	108	35	109	71	111	
	2016 Logistics Performance Index (Rank / 160)	66	55	46	94	54	69	
Growth	2016 GDP (US\$ billion)	545.87	1,796.19	247.03	282.46	1,046.00	192.09	
	2016 GDP Growth (percent)	-2.30	-3.59	1.58	1.96	2.30	3.88	
Development	2016 GDP per Capita (US \$)	12,449.22	8,649.95	13,792.93	5,805.61	8,201.31	6,045.65	
	2015 Human Development Index (Rank / 188)	45	79	38	95	77	87	
Competitiveness	2017 WEF Competitiveness (Rank / 137)	92	80	33	66	51	72	
Equality	2015 GINI Index	42.7*	51.3	47.7	51.1	48.2*	44.3	*2014 data

The highest scores in each category are indicated in green while the lowest scores are indicated in red.

⁵⁶ Adapted from WEF GCI Dataset 2006–2017; Transparency International, *Corruption Perceptions Index 2016*; Calderón and Servén, “Infrastructure in Latin America,” *Infralataam Database*; World Bank, *World Development Indicators*; World Bank *206 Logistics Performance Index*; United Nations Development Program, *2015 Human Development Index*. Data sources can be found in Appendix B.

3. Sources and Definitions

With those three case studies in mind, I concentrate my research on academic sources relevant to the institutional, policy, and leadership debates of those countries and apply them to the context of their infrastructure investment and development levels expressed via indicators of infrastructure quantity, quality, and access, along with additional data from governmental and non-governmental organizations such as the World Bank, IMF, OECD, WEF and development banks such as CAF and the Inter-American Development Bank (IDB).

Before proceeding however, a quick overview of measures of infrastructure quality, quantity, and access is warranted. *Qualitative measurements*, as the name suggests, indicate the effectiveness or level of performance of available infrastructure and come in two varieties: quantitative measures of quality and surveys. Quantitative measurements of quality usually come as official statistics and indicate aspects such as wait times for services to signify an inadequate supply, distribution losses, or paved roads as a percentage of the total. Surveys, on the other hand, are assessments of infrastructure quality usually carried out by experts but, while they risk faulty comparability over time if survey questions change, their biggest limitation currently comes from lack of historic data due to their more recent application.

Quantitative measurements are the most empirical and straightforward way of measuring infrastructure and characteristically consist of measures of length, density, volume, units produced, units transported and are sometimes calculated as a per capita measurement to facilitate comparisons over time or between countries. Although they may be straightforward, officially recorded statistics on infrastructure quantity (as well as quantitative measurements of quality) can vary over time in terms of availability, regularity, and precision.

Finally, *measures of access* to infrastructure are concerned with the universality or “the extent to which existing infrastructure assets yield services to the broad

population rather than just a few.”⁵⁷ A country could build the longest, highest capacity, and highest quality road, but if it is located away from population centers, it will have little to no impact on the country’s economic growth. For this reason, access to infrastructure is normally measured as a percentage of people that have access to or live within a certain distance of roads, phones, electricity, or clean water. However, based on the limited amount of available infrastructure access data, historic trends are difficult to analyze. With those definitions in mind, we can proceed to review each case study’s infrastructure in a comparative context.

⁵⁷ Calderón and Luis Servén, “Infrastructure in Latin America,” 10.

II. BRAZIL'S INFRASTRUCTURE TRENDS IN CONTEXT

A. BOTTLENECKS

In the case of Brazil, Garcia-Escribano, Goes, and Karpowicz state, “inadequate infrastructure is increasingly identified as the key bottleneck behind low productivity, stagnating export performance, insufficient domestic market integration, and weak growth potential.”⁵⁸ While drawing comparisons between Brazil and its main export competitors—the United States, Canada, India, Argentina, Australia, China, Kazakhstan, Mexico, Russia, and South Africa—based upon its 10 largest commodity exports (sugar, soy beans, meats, and coffee, iron ore, iron and steel, corn, mineral fuels, vehicles, and aircraft), they find that Brazil has “inferior overall infrastructure quality relative to almost all its export competitors” and “quantitative indicators of infrastructure also paint a grim picture.”⁵⁹ Perhaps one of the most significant insights is that Brazil maintains the lowest ratio of paved roads among its competitors (less than 15 percent) with the majority being single-lane while it has the second highest density of vehicles per kilometer of paved road (after Mexico) and transports the greatest percentage of agricultural goods via highways.⁶⁰

It is not surprising to come across anecdotes like one Credit Suisse notes of lines of trucks 10-miles long waiting to unload their crops at the port.⁶¹ In fact, Credit Suisse reports that inefficiencies created by bottlenecks in Brazil's transportation infrastructure alone subtract 10 to 15 percent from its GDP and that it must double its “meager” infrastructure investment rate of 2 percent of GDP in order sustain what was, at the time, a 4 percent growth rate.⁶² It is important to note that those estimates were mostly derived at the close of the 2004–2013 decade, considered an exceptional one for Brazil, in terms

⁵⁸ Mercedes Garcia-Escribano, Carlos Goes, and Izabela Karpowicz, “Filling the Gap: Infrastructure Investment in Brazil,” *IMF Working Paper 15/180* (Washington, DC: IMF, 2015): 4.

⁵⁹ *Ibid.*, 9.

⁶⁰ *Ibid.*, 9–10.

⁶¹ Bruno Savaris, Felipe Vinagre, and Daniel Magalhaes, *The Brazilian Infrastructure: It's “Now or Never” From an Economic Growth Constraint to a Plethora of Opportunities* (Credit Suisse, 2013).

⁶² *Ibid.*

of economic growth and social progress.⁶³ Unfortunately, recent challenges including weak external demand, declining commodity prices, and global financial market volatility have dimmed the region's economic outlook,⁶⁴ with Brazil experiencing some of the greatest effects as its GDP contracted by -3.8 and -3.6 percent in 2015 and 2016 respectively.⁶⁵ While infrastructure alone is not sufficient in explaining Brazil's broader economic challenges, available indicators and reports shed substantial light on Brazil's infrastructure gap in relative terms.

B. QUALITY, QUANTITY, AND ACCESS

A glance at recent WEF rankings for infrastructure quality in Figure 7 place Brazil's situation into a global context. The WEF currently ranks the quality of Brazil's overall infrastructure at a disappointing 108 out of 137 countries surveyed.⁶⁶ When combined with other measures of quality and quantity, Brazil's ranking fares slightly better at 72 out of 138 (Figure 8). However, when one considers that Brazil currently has the ninth largest economy in the world along with aspirations to become a global leader, its infrastructure performance appears even more discouraging.

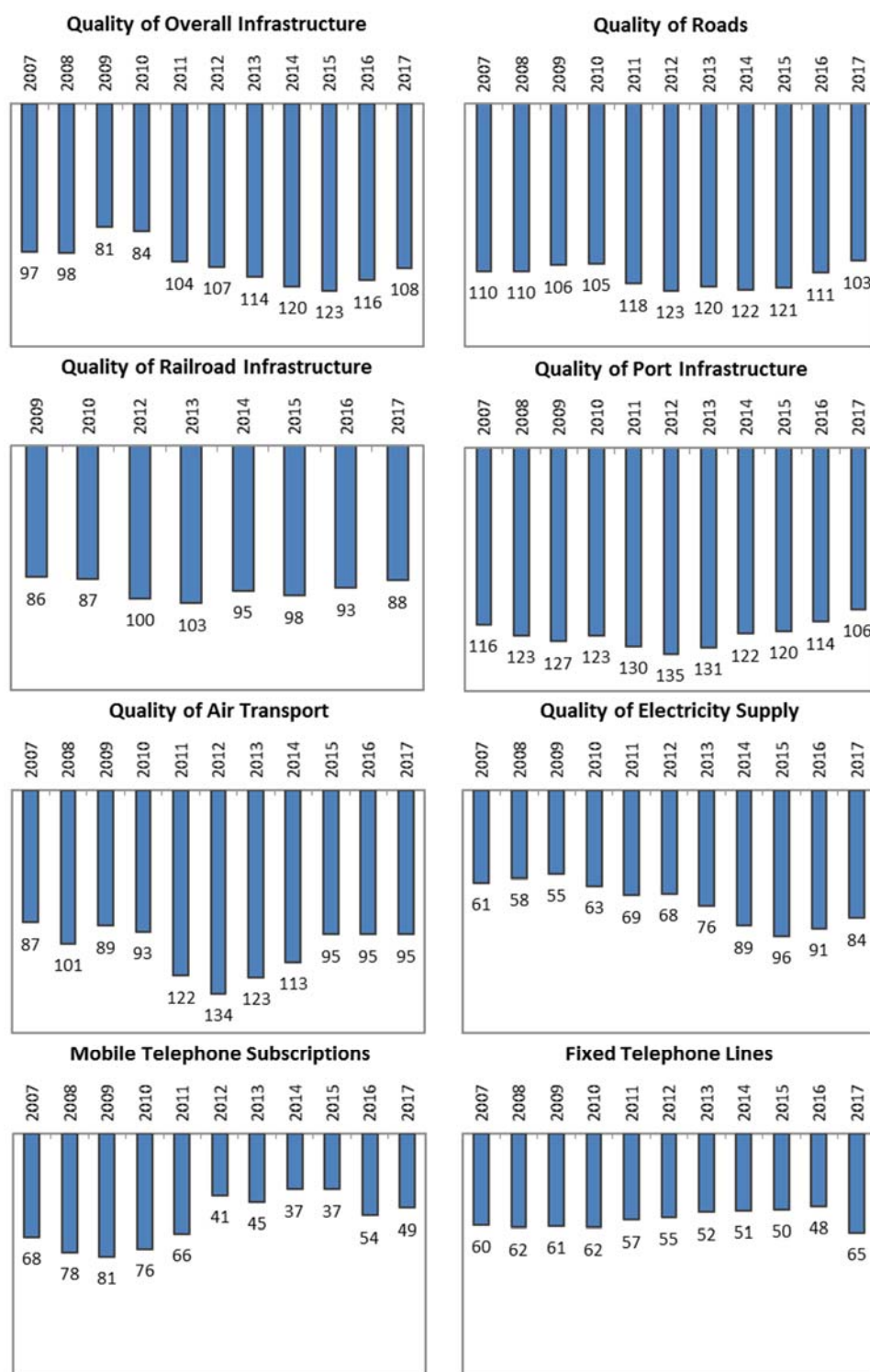
⁶³ Ocampo, 1.

⁶⁴ IMF, *Regional Economic Outlook*, 15–17.

⁶⁵ The World Bank, World Development Indicators.

⁶⁶ Klaus Schwab, ed., *The Global Competitiveness Report 2017–2018* (Geneva, Switzerland: World Economic Forum, 2017), 70–71.

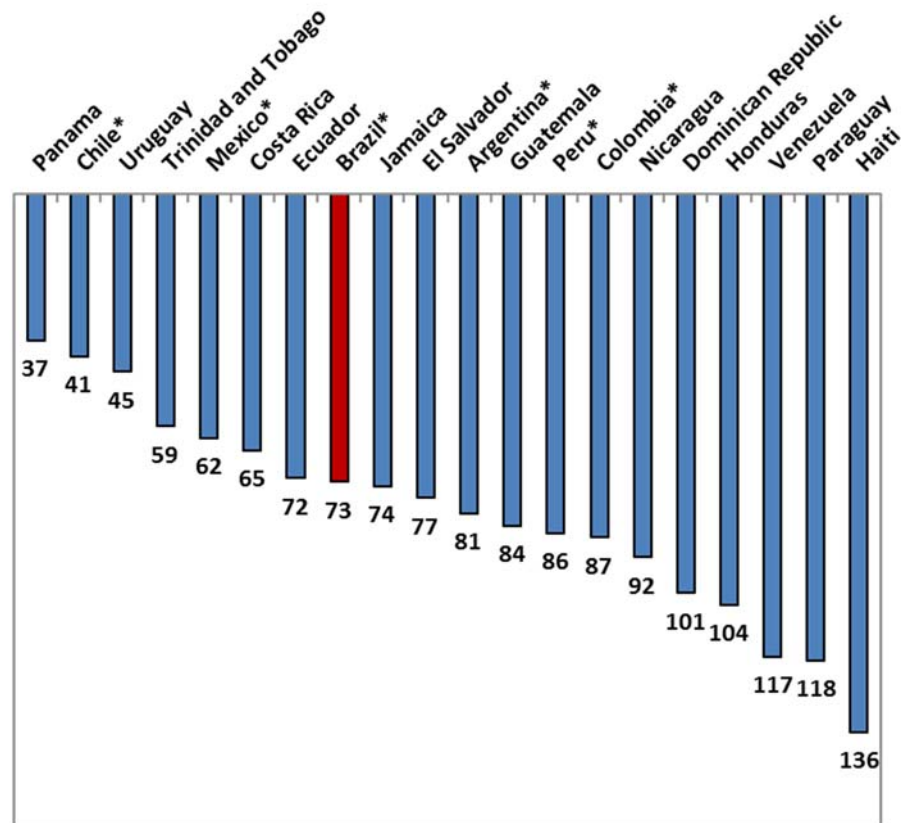
Figure 7. Brazil: WEF Infrastructure Quality Indicators, 2007–2017⁶⁷



⁶⁷ Adapted from WEF GCI Dataset 2006–2017.

While the WEF provides valuable, survey-based and quantitative data across a number of infrastructure indicators going back over a decade, to get a better view of the longer-term trends in transportation, energy, and telecommunications quality and quantity for Latin America in a comparative context, we can turn to the five-year averages that Calderón and Servén calculate across three decades in Figure 9. For transportation, they focus specifically on land transportation with measures of quality indicated via the percentage of paved roads relative to the entire network and quantity indicated via measurements of road density—calculating the total length of roads in a country relative to its total area to indicate quantity. For energy, they measure quality in terms of efficiency, reporting the percentage of electric power transmission and distribution losses relative to total output and quantity measured as each country’s electric generation capacity in megawatts per 1,000 workers. Finally, they indicate telecommunications quality through waiting times in years (adjusted to a 0 to 1 scale with higher values indicating shorter wait times) and telecommunications quantity as telephone density (the total number of land and mobile lines per 1,000 workers).

Figure 8. Brazil: WEF Infrastructure Rank, 2017⁶⁸



1 = Best, 137 = Worst. *LAC-6 Countries.

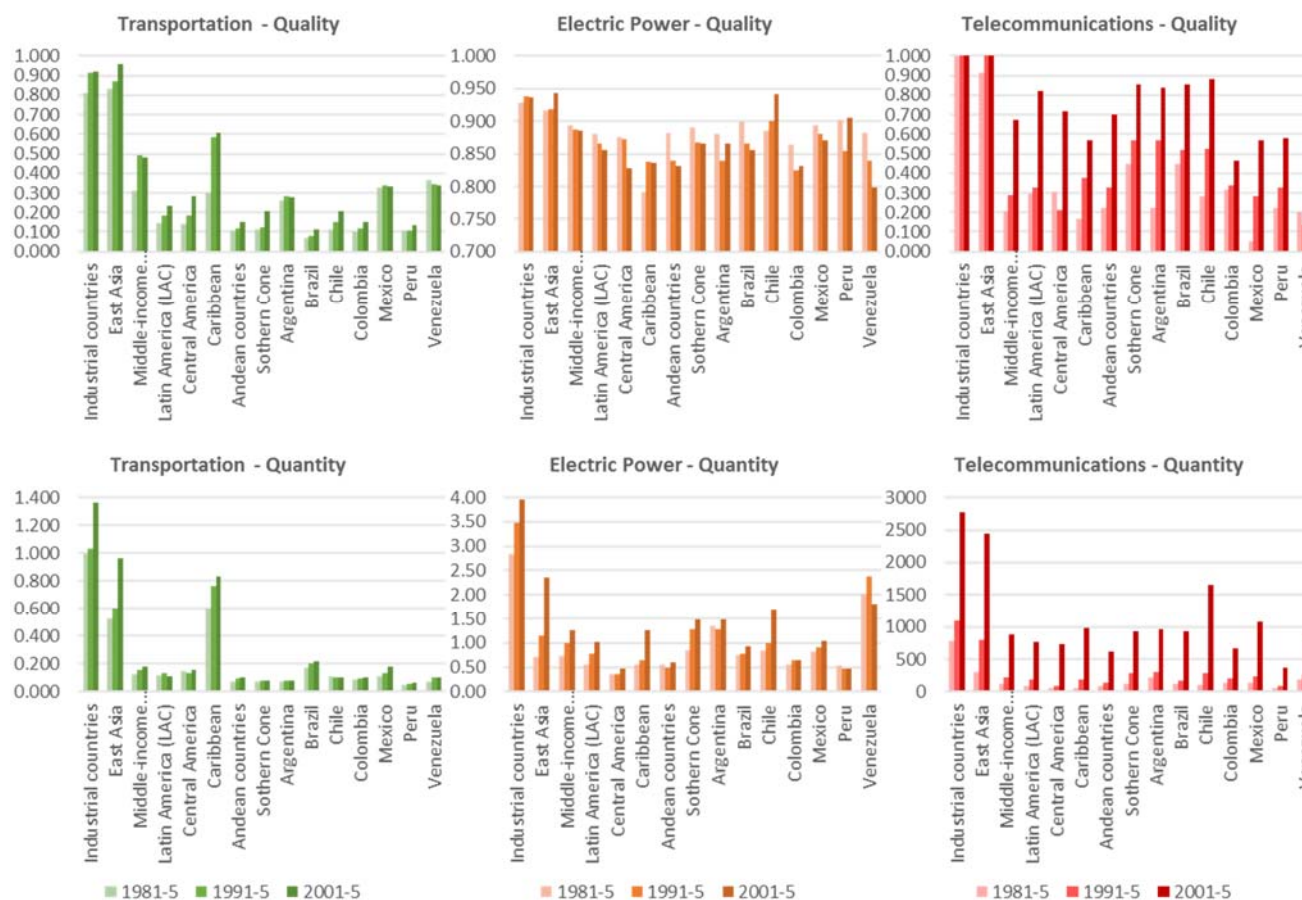
Looking specifically at Calderón's and Servén's indicators of Brazil's infrastructure relative to the other countries and regions, in terms of transportation we can see that while Brazil has maintained a greater density of roads than its Latin American and middle-income peers, its lower percentage of paved roads brought its quality measurements below every other country and segment examined—although both indicators did slightly improve over time. Brazil does perform somewhat better in both the quality and quantity of its electric power generation and distribution, achieving close to the Latin American average. However, while Brazil did improve quantity (electricity generation capacity) over time, that improvement was accompanied by a corresponding decrease in quality (indicated by higher transmission and distribution losses).

⁶⁸ Adapted from WEF GCI Dataset 2006–2017.

Measurements of Brazil's telecommunications infrastructure paint a similar picture; beginning the period with relatively higher levels of quality, its neighbors closed the gap over the subsequent decades while indicators of quantity markedly increased after the 1990s. Comparing trends in Calderón's and Servén's data with the WEF's more contemporary reports in Figure 7, we get a sense that the quality and quantity of Brazil's infrastructure has continued along similar trajectories with the lone exception being telecommunications access, indicated through a greater proportion of mobile phone subscriptions.

Turning to indicators of access, Figure 10 provides a snapshot of the percentage of Brazil's rural population that lives within 2 kilometers of an all-season road relative to 31 other LAC countries. While that data represents only one measurement for each country (taken between 1999 and 2004), Brazil's 2001 value of 53 percent places it at 26th place in the region and 5th out of the LAC-6 countries. Additional World Bank infrastructure access indicators in Figure 11 do show slightly better performance compared to the rest of the region as a higher than average percentage of both Brazil's rural and urban populations benefit from access to electricity and improved water. Unfortunately, Brazil's rural population does not have similar access to improved sanitation with the gap between them and the rest of Latin America's rural population increasing over time.

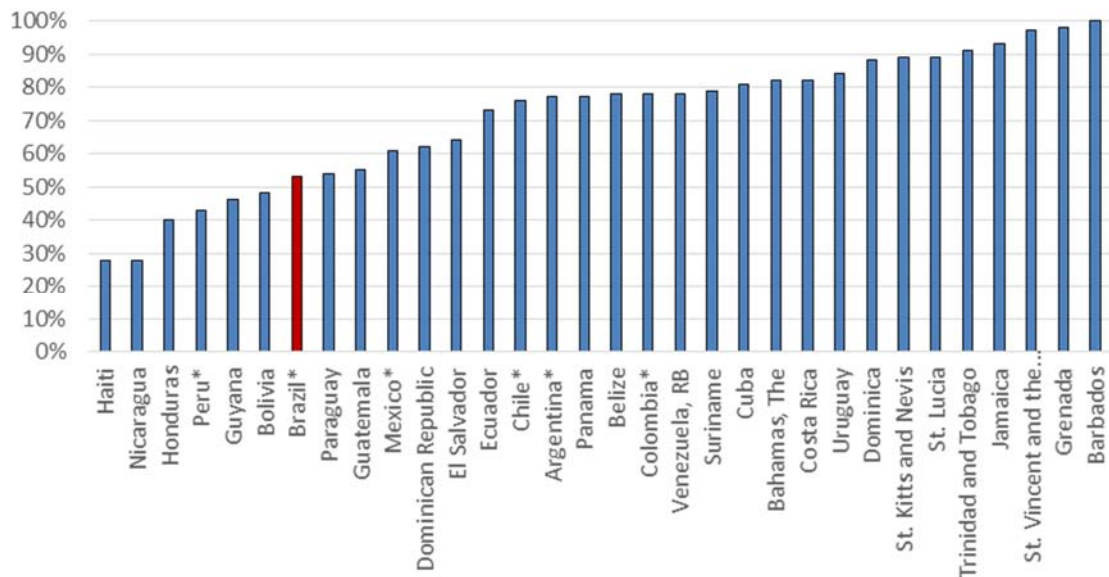
Figure 9. Latin American Infrastructure Quality and Quantity Indicators, 1981–2005⁶⁹



⁶⁹ Adapted from Calderón and Luis Servén, “Infrastructure in Latin America.”

When viewed holistically, measurements of Brazilian infrastructure quality, quantity, and access display a number of sectoral trends. First, transportation is clearly a weakness. While the relative quantity of transportation infrastructure may provide some benefits, they are evidently outweighed by some of the lowest levels of quality and access, not only in the region but among other middle-income countries as well, altogether lending support to the Credit Suisse’s observation on the significant impact that transportation bottlenecks alone have on Brazil’s GDP. Next, while Brazil does display better performance than the LAC-6 average in terms of electricity and water and sanitation, it still falls behind its middle-income peers. Perhaps Brazil’s best performance is found in telecommunications. While not the strongest performer in the region in terms of available measures of quality and quantity (which one can use for a proxy of access) Brazil does perform better than some other middle-income countries. Overall, these trends become even more significant when compared to the levels of investments that Brazil has made in each sector over time.

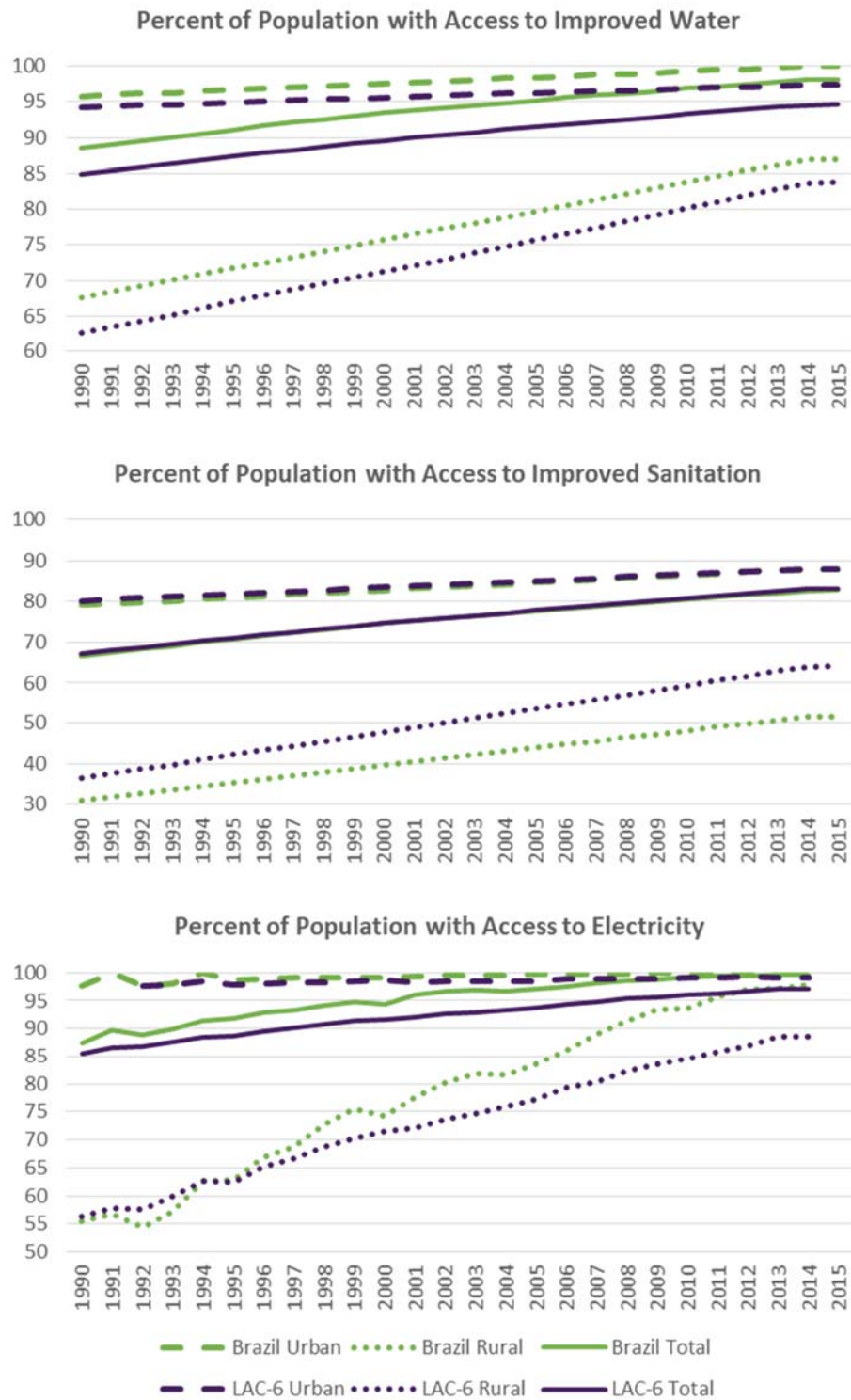
Figure 10. Brazil: Rural Access Index, 1999–2004 Data⁷⁰



Percentage of rural population living within 2 kilometers of an all-season road. *LAC-6 Countries. Brazil’s data is from 2001.

⁷⁰ Adapted from World Bank, Rural Access Index.

Figure 11. Brazil: Infrastructure Access Indicators, 1990–2015⁷¹



⁷¹ Adapted from World Bank, World Development Indicators.

C. INVESTMENT LEVELS

Numerous sources have compiled data on Brazil's infrastructure investment over time and examining the trends points to a recent, protracted period of depressed investment rates. Credit Suisse reports that, while Brazil's infrastructure investment peaked in the 1960s and continued at an average of 5.42 percent of GDP through the 1970s, rates dropped to 3.62 percent in the 1980s due in large part to fiscal constraints stemming from the debt crisis.⁷² Combined public and private infrastructure investment levels continued to decline through the 1990s and 2000s (averaging 2.29 and 2.16 percent respectively)⁷³ due primarily, as Garcia-Escribano, Goes and Karpowicz note, to a marked decrease in public investment with no corresponding increase from the private sector.⁷⁴ Credit Suisse reveals that GDP growth over the decade ending in 2013 corresponded nearly proportionally to total government investment levels with Brazil lagging behind the rest of the BRIC league (see Figure 12).⁷⁵ Credit Suisse also indicates that Brazil's deficient infrastructure investments have recently caused deterioration in the quality of its infrastructure stocks, effectively widening the gap with its peers. Moreover, as of 2012, Brazil's infrastructure stocks stood at a meager 16 percent asset-to-GDP ratio, contrasting a global average of 71 percent and indicating that an additional \$1 trillion investment would be required to close the gap.⁷⁶

Credit Suisse also reveals an important difference in investment levels across sectors, indicating that high levels of investments in electricity and telecommunications reflect greater participation of the private sector through concessions, and that those sectors are consequently the only ones in which Brazil maintains a higher ranking than some of its competitors.⁷⁷ More recent data reflects a slight increase in infrastructure

⁷² Savaris, Vinagre, and Magalhaes.

⁷³ Ibid.

⁷⁴ Garcia-Escribano, Goes, and Karpowicz, 11–12.

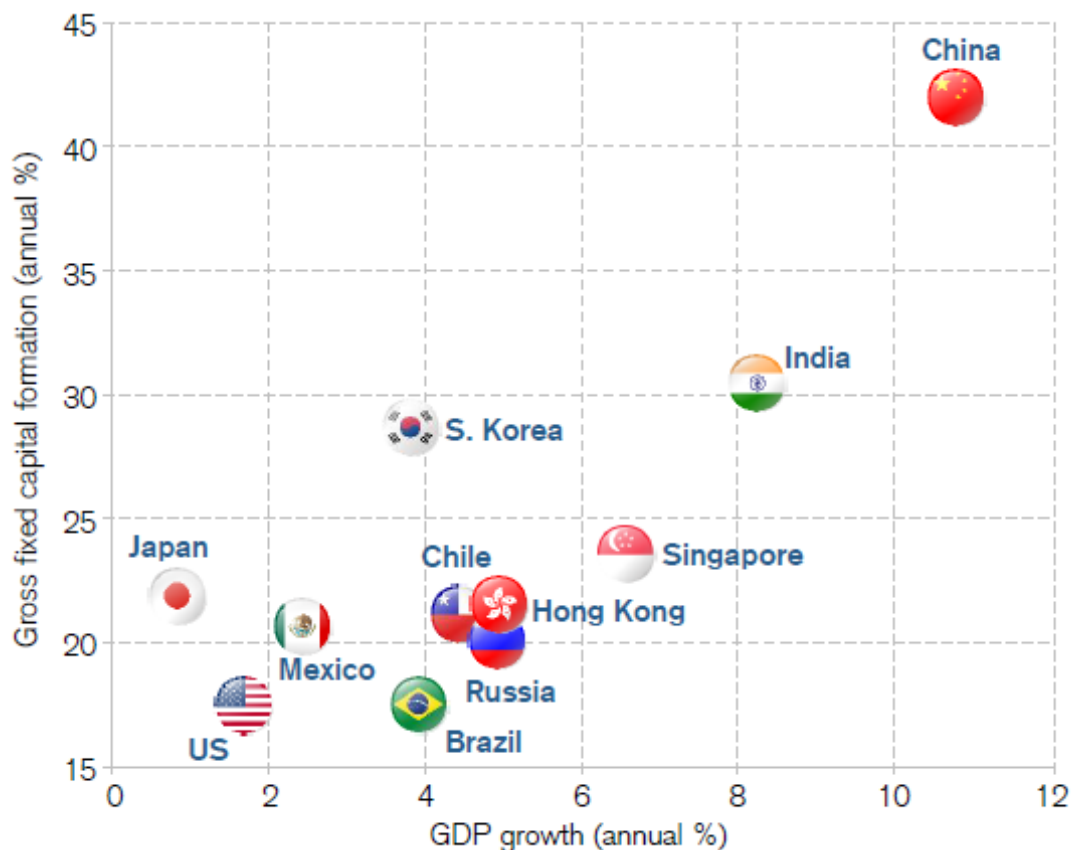
⁷⁵ Savaris, Vinagre, and Magalhaes; Brazil invested, on average, 17.5 percent of GDP compared to 30 percent in India and 42 percent in China while Brazil's GDP growth averaged 4 percent, with India and China growing at a rate of 8.2 percent and 11 percent, respectively.

⁷⁶ Ibid.; compared to 58 percent in India and 76 percent in China.

⁷⁷ Garcia-Escribano, Goes, and Karpowicz, 9.

investment prior to Brazil's present recession, but the consensus remains that the current infrastructure gap is mostly the result of prolonged underinvestment and, as Credit Suisse states, "an ultimate improvement in Brazil's infrastructure won't come through greater public investments in the sector but rather by promoting a friendlier environment to private investments."⁷⁸

Figure 12. Brazil: Fixed Capital Formation vs. GDP Growth, 2004–2013⁷⁹



So, what does the breakdown of Brazil's infrastructure investments look like over time and by sector when compared with LAC-6 averages? A study of Figure 13 and Figure 14 exposes a few of the trends. As other authors have indicated, while total infrastructure investment levels dropped significantly beginning in the late 1980s and

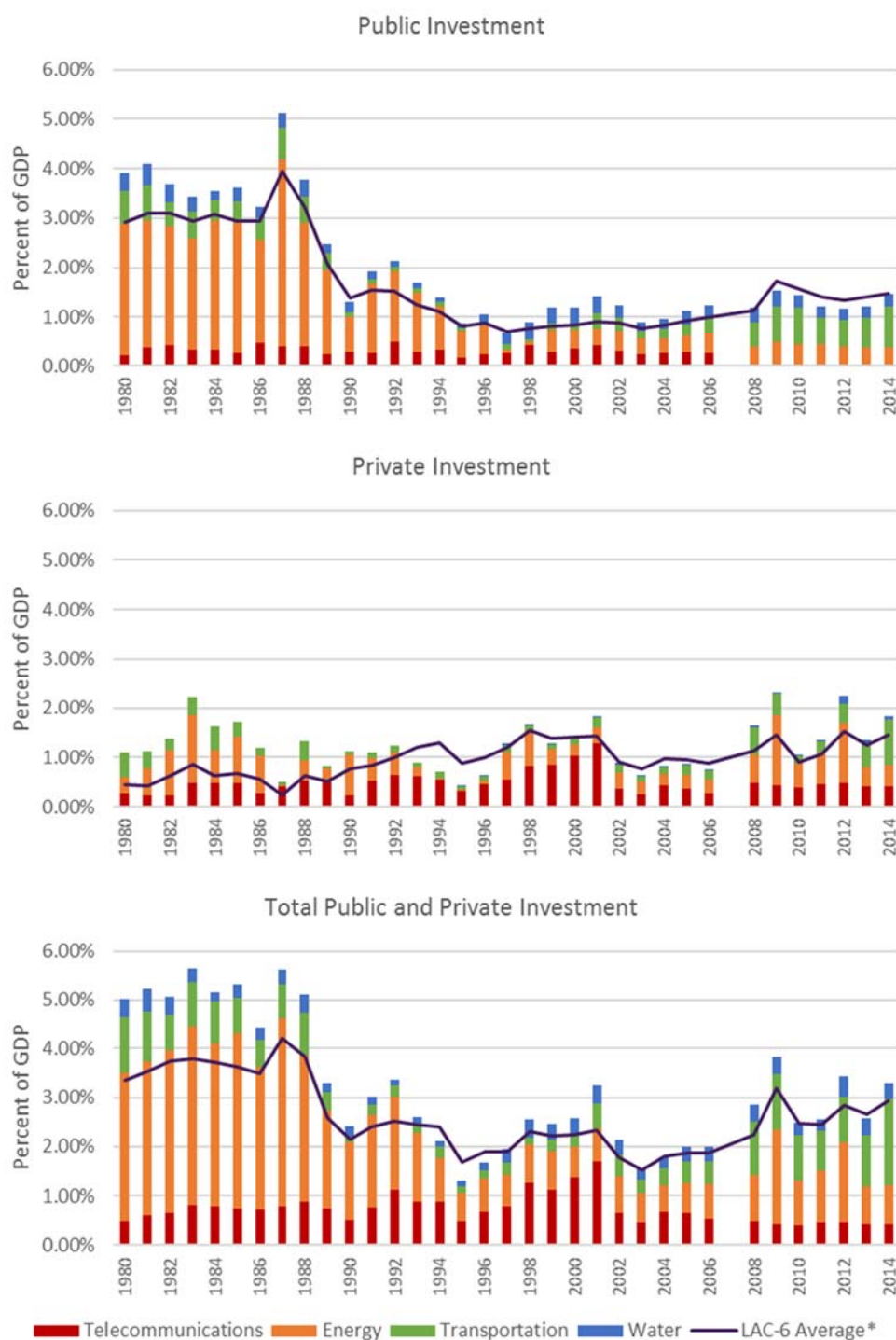
⁷⁸ Savaris, Vinagre, and Magalhaes.

⁷⁹ Source: Savaris, Vinagre, and Magalhaes.

have continued to fluctuate since, Brazil has maintained higher than average combined public and private investment levels with the one exception being the early to mid-1990s. Additionally, the majority of Brazil's infrastructure investment has come from the public sector which consistently saw higher than average levels from the beginning of the dataset in 1980 up until 2008. Private investment, on the other hand, has seen many more years with lower than average levels—primarily in the mid-1990s and early 2000s, although that trend seems to have reversed in more recent years.

When comparing the relative weight of investments in each infrastructure category over time, we can see that for the first half of the period indicated, Brazil has regularly directed the majority of its investments into the energy sector. Additionally, since the mid-1990s, it appears that private investment has become a larger part of Brazil's total energy investments, in part helping to keep Brazil's total energy investment levels consistently higher than the LAC-6 average. And while Brazil has invested in telecommunications at a lower rate than in the energy sector, the trend has been to utilize a greater proportion of private investments, resulting—like with energy—in consistently higher than average investment levels, although Brazil has not been significantly surpassing those averages since 2002. One marked shift in investment trends, beginning around the year 2000, has been for Brazil to increase both public and private investment in transportation infrastructure. After about a decade of extremely low levels of transportation infrastructure investment beginning around 1990, Brazil has begun to direct a greater portion of its overall in infrastructure investments towards transportation with a significant portion coming from the private sector in what reflects trends not seen since the 1980s. Unfortunately, with very few exceptions Brazil's total investments in transportation infrastructure investments have failed to meet the LAC-6 averages. Finally, in terms of Brazil's water and sanitation, while representing the smallest portion of total investments, Brazil has consistently surpassed the LAC-6 average investment levels (minus a small dip in the early 1990s), and has moved to incorporate a larger amount of private investment in more recent years.

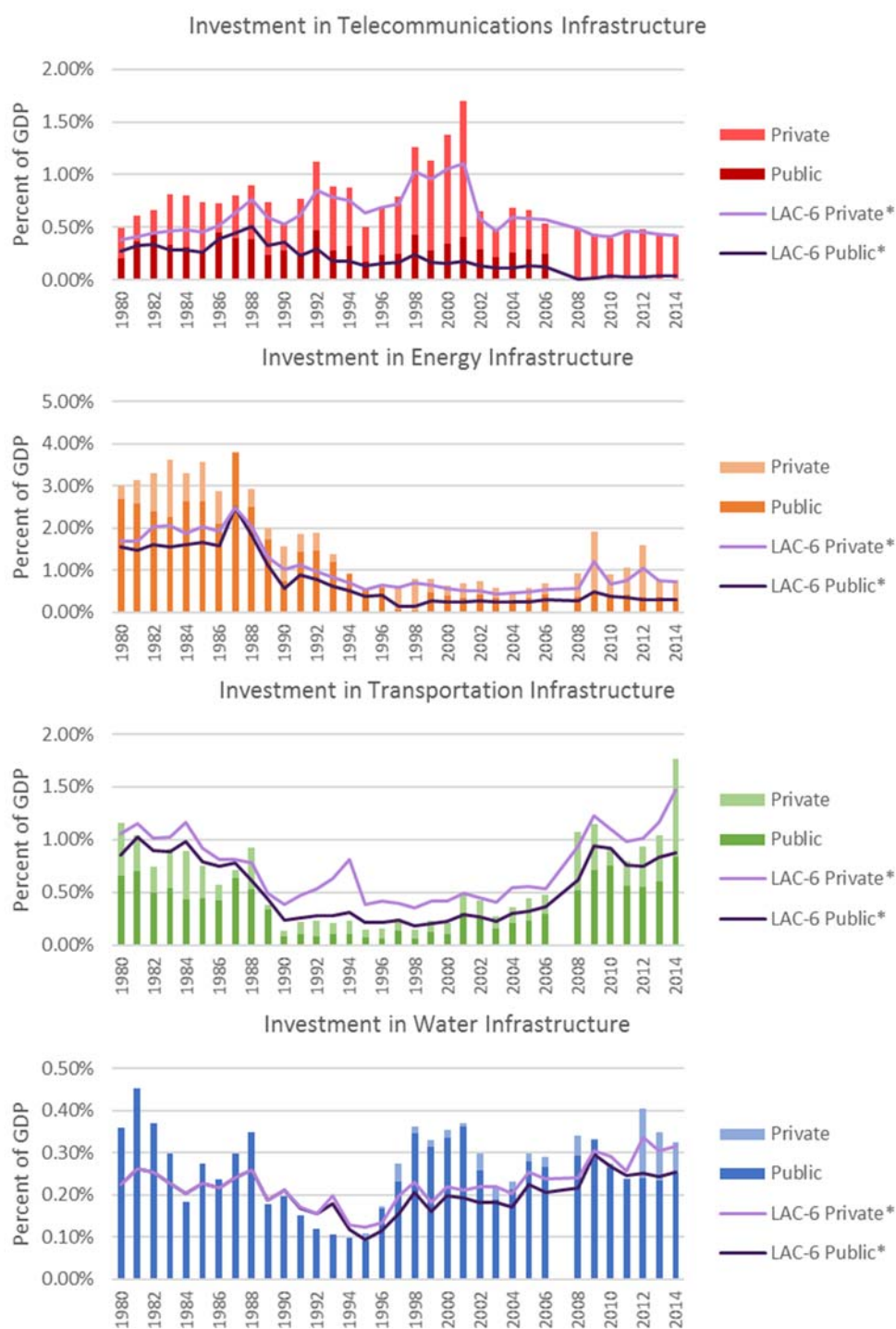
Figure 13. Brazil: Public and Private Investment in Infrastructure, 1980–2014⁸⁰



*GDP-weighted average. 2007 data not available.

⁸⁰ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralataam Database.

Figure 14. Brazil: Infrastructure Investment by Sector, 1980–2014⁸¹



*GDP-weighted average. 2007 data not available.

⁸¹ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

Overall, we can draw a direct correlation between Brazil's investment levels across infrastructure sectors and indicators for quality, quantity, and access. Brazil's highest two performing sectors—telecommunications and energy—have generally been supported by higher than average levels of both public and private investments. Whereas transportation—singled out as a physical and metaphorical bottleneck to GDP growth in Brazil—has suffered from significantly lower investment levels, although recent trends show movement in the right direction. Looking at investment levels more generally, perhaps Brazil's greatest weakness has been a prolonged period of lower than average private investments stretching from the early 1990s to the late 2000s. At this point, we can examine how institutions have influenced policy actions as well as the incentives of individual leaders to shape Brazil's infrastructure investment climate and trends over time.

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III. BRAZIL'S INSTITUTIONAL EFFECTS

While the evidence above points to not just low levels of investment—but also translating those investments into infrastructure quality, quantity, and access—as immediate causes of Brazil's infrastructure gap, understanding the shape and function of Brazil's formal and informal political institutions go a long way in revealing the forces that structure the incentives and constraints of politicians and policy makers and may subsequently explain why—despite higher than average levels of infrastructure investment in some categories—quality and quantity have been steadily lacking. Two distinct but related formal political institutions in Brazil emerge as having a significant effect on economic policy in general along with direct linkages to infrastructure: federalism (how it determines the level of political and fiscal decentralization) and the open-list, proportional electoral system. In combination, these two formal institutions create a framework upon which informal institutions—identified as “electoral markets” and classified along a spectrum from clientelistic to programmatic—work together to shape candidate-voter and executive-legislative relationships along with their associated incentives in Brazil.⁸²

A. POLITICAL AND FISCAL DECENTRALIZATION

Brazil has historically been the most decentralized country in Latin America due, in large part, to its federal system.⁸³ Despite efforts to centralize political power by both Getúlio Vargas in the 1930s and 1940s and the military dictatorship of the 1960s to 1980s, Samuels indicates that Brazil's traditional political organizational structure continues to be based on state networks with governors retaining tremendous power, “as opposed to strong, centralized national party organization.”⁸⁴ Additionally, Samuels

⁸² Scott W. Desposato, “How Informal Electoral Institutions Shape the Brazilian Legislative Arena,” in *Informal Institutions and Democracy: Lessons from Latin America*, ed. Gretchen Helmke and Steven Levitsky (Baltimore, MD: Johns Hopkins University Press, 2006), 56–68.

⁸³ David J. Samuels, “The Political Logic of Decentralization in Brazil,” in *Decentralization and Democracy in Latin America*, ed. Alfred P. Montero and David J. Samuels (Notre Dame, IN: University of Notre Dame, 2004), 67.

⁸⁴ *Ibid.*, 68–71

describes how Brazil's current wave of decentralization (rooted in the actions of the military dictatorship and resulting from the process of democratization beginning in the 1980s) has led to some significant transformations. Specifically, he explains that in an effort to limit the autonomy of local governments, the military dismantled both state- and party-based political structures upon seizing power, while simultaneously allowing municipal elections to continue as scheduled.⁸⁵ This had two unintended consequences: first, aspiring politicians under the military regime found that they had a role to play in the municipalities; second, without the state governments acting as intermediaries, municipal mayors interacted with the federal government in a more systematic and bureaucratic fashion, enabling them to claim the credit for government programs implemented at the local level.⁸⁶

Contrasting other democratizing Southern Cone countries that chose to hold national elections prior to subnational ones, in a slow, coordinated transition to democracy beginning in the early 1980s, Brazil's military leadership began to allow elections for senators and state governors while retaining control of the presidency and the central bureaucracy.⁸⁷ As a result, Samuels states, "democratically elected governors grew increasingly independent of the central government...the political elite's electoral energies focused on state politics and conquest of state offices...to the detriment of national parties and national issues."⁸⁸ The increased power and influence of the states relative to the federal government means that candidates running for a position within the national Chamber of Deputies continue to forge political alliances with state-level office holders, giving state governors significant influence over legislative elections, and increasing the state-based orientation of federal deputies.⁸⁹ Moreover, a majority of Brazil's federal deputies tend to serve only one or two terms, using that office as a stepping-stone to seek election and to further their political career at the municipal level,

⁸⁵ Ibid., 69.

⁸⁶ Ibid.

⁸⁷ Ibid., 79.

⁸⁸ Ibid.

⁸⁹ Ibid.

resulting in, as Samuels states, a “comparatively low degree of electoral nationalization of most of Brazil’s parties.”⁹⁰

In addition to the increasing political autonomy of state and municipal governments in Brazil, the process of decentralization devolved additional fiscal autonomy to the local level as well. As Eaton identifies, this process predates the democratic transition, beginning with the military bureaucracy doubling the share of taxes going to states and municipalities in 1975 and reducing the extent of earmarking in 1979.⁹¹ The National Congress, although weakened under the dictatorship, foresaw the ultimate direction that political decentralization was taking and passed the *Passos Porto* Amendment in 1983 and the *Airton Sandoval* Amendment in 1985 (which progressively decentralized revenue and resources to local levels) in an effort to strengthen their own future political prospects at the state and local level.⁹² The 1988 Constitution further increased local autonomy by replacing most discretionary fiscal transfers to states and municipalities with automatic ones while dramatically shifting expenditures to the municipal level as well. “The great net beneficiary of the redistribution were local governments,” Sturzenegger and Werneck argue, with municipalities gaining access to roughly triple their previous share of national tax revenue (from less than 5 percent to almost 15 percent) with Brazil’s poorest states in particular obtaining the largest net gain.⁹³ This, combined with a new, constitutionally granted legal status as “federal entities” gave municipalities—or more importantly, municipal political leaders—additional authority to provide a wide range of public services, including healthcare, education and infrastructure, at a level “unheard of across the continent.”⁹⁴

⁹⁰ Ibid., 79–80, 83.

⁹¹ Kent Eaton, “The Link between Political and Fiscal Decentralization in South America,” in *Decentralization and Democracy in Latin America*, ed. Alfred P. Montero and David J. Samuels (Notre Dame, IN: University of Notre Dame, 2004), 141.

⁹² Samuels, 88–89.

⁹³ Frederico Sturzenegger and Rogério L. F. Werneck, “Fiscal Federalism and Procyclical Spending: The Cases of Argentina and Brazil,” in *Fiscal Policy, Stabilization and Growth*, ed. Guillermo E. Perry, Luis Servén, and Rodrigo Suescún, (Washington, DC: World Bank, 2008), 150–151.

⁹⁴ Samuels, 89–90.

Specifically regarding infrastructure investment at this time, Garcia-Escribano, Goes, and Karpowicz note that as the 1988 Constitution increased automatic transfers to state and local governments it “replaced sector-specific federal taxes earmarked to energy, transport, and telecommunications with non-specific state-level ones.”⁹⁵ However, as Armijo and Rhodes point out, there was no “corresponding reallocation of obligatory infrastructure responsibility,” to the state and municipal level, thus leaving the federal government with an “unfunded mandate.”⁹⁶ This directly corresponds to the pattern of investment presented in Figure 13, indicating that public investment in infrastructure decreased as state and municipal governments gained additional fiscal and political autonomy through decentralization.

B. THE ELECTORAL SYSTEM

Another of Brazil’s formal political institutions has had a tremendous impact on the structure and strength of political parties along with the behavior and strategies that politicians have pursued: its system of electoral rules and laws that emerged in its current form through the transition to democracy. In a thorough examination of the key features of the Brazilian electoral system, Mainwaring illustrates that Brazil’s electoral rules—relative to other Latin American countries—grant politicians a great deal of autonomy and encourage personalistic behavior, undermining the effectiveness of political parties due to low levels of loyalty and discipline.⁹⁷ Within the entire political system, Mainwaring notes, “all of three most common methods of allocating seats (absolute majority with single member districts, plurality with single member districts, and proportional elections) play an important role.”⁹⁸ In executive positions (including the president, governors, and mayors of large cities), where the majority of political power is concentrated, victory requires an absolute majority of votes with a runoff between the top

⁹⁵ Garcia-Escribano, Goes, and Karpowicz, 12.

⁹⁶ Leslie Elliott Armijo and Sybil D. Rhodes, “Explaining Infrastructure Underperformance in Brazil: Cash, Political Institutions, Corruption, and Policy Gestalts,” *Policy Studies* 38, no. 3 (March 2017): 239–240.

⁹⁷ Scott Mainwaring, “Politicians, Parties, and Electoral Systems: Brazil in Comparative Perspective,” *Comparative Politics* 24, no. 1 (October 1991): 21.

⁹⁸ *Ibid.*, 21–22.

two vote-getters if a 50-percent majority is not obtained in the first round. Alternatively, the system for electing senator and the mayors of smaller cities (those with less than 200,000 voters) is a first-past-the-post, single round plurality election. Otherwise, voters select their representatives (including state and federal deputies as well as members of town councils), through an open-list list, proportional system in which they cast their ballot for one candidate only with seats “distributed first to parties according to the total number of votes their candidates get, and then within parties according to the number of individual votes,” so that “even though the number of representatives is determined by party votes, whether or not a candidate is elected depends on his/her ability to obtain individual votes.”⁹⁹

Supplementing these voting methods are a few other rules, instrumental to the workings of the system. For example, the *candidato nato* (birth-right candidate) rule allows representatives at the federal, state and local level to automatically retain the right to be on the ballot for the next election cycle even if they switch parties; also, there are no rules preventing elected representatives from switching parties at any time; plus, each party has the ability to present 1.5 candidates for every seat to be filled at the federal and state level and 3 candidates for every seat at the municipal level.¹⁰⁰ When combined with the benefits that come from elected offices, these rules have placed a premium on individual campaign spending with dramatic increases in recent years.¹⁰¹ Ames points out that, with the exception that candidates are not allowed to buy radio or television advertisements and instead they rely on receiving a portion of the free television time that the government allocates to parties, spending laws are permissive.¹⁰² What emerges is a system “in which federal legislative candidates pay for the campaign literature of assembly candidates whose bases of support lie far away. The assembly candidates

⁹⁹ Ibid., 23–24

¹⁰⁰ Ibid., 24–25.

¹⁰¹ Ibid., 27.

¹⁰² Barry Ames, *The Deadlock of Democracy in Brazil* (Ann Arbor, MI: University of Michigan Press, 2002), 43.

reciprocate by instructing supporters to vote for their benefactor for the national legislature.”¹⁰³

Moreover, peculiarities in the representation of individual states at the national level create a phenomenon identified as “asymmetrical federalism.”¹⁰⁴ Selcher shows that, in an effort “to prevent domination of the federation by a single state (namely São Paulo),” Article 45 of the 1988 Constitution provides states with a minimum of eight and a maximum of 70 representatives in the 513-seat national Chamber of Deputies.¹⁰⁵ Additionally, legacies persist from the 1946 Constitution, providing each state with three senators for eight-year terms that, when combined with the maximum seat restriction in the Chamber of Deputies, result in an imbalance of national representation in favor of smaller, rural, and typically poorer states.¹⁰⁶ Correspondingly, as of the mid-1990s Brazil’s six most developed states (located in the South and Southeast) represented 58.3 percent of the population and contributed 79.7 percent to the national economy but only had 48 percent of the votes in the Chamber of Deputies, and 22 percent of the votes in the Senate, making Brazil’s congress one of the most malapportioned among the democratic world.¹⁰⁷ One consequence of this imbalance is the emergence of regional alliances among Brazilian states along a north-south axis, with the poorer and traditionally more conservative regions able to block legislation and constitutional amendments based on their overrepresentation.¹⁰⁸

C. INFORMAL INSTITUTIONS: ELECTORAL MARKETS

Formal institutions, however, only represent part of the picture. Desposato makes a strong argument for the importance of informal institutions in better understanding political phenomena through his case study of electoral markets in state legislatures in

¹⁰³ Ibid.

¹⁰⁴ Wayne A. Selcher, “The Politics of Decentralized Federalism, National Diversification, and Regionalism in Brazil,” *Journal of Interamerican Studies and World Affairs* 40, no. 4 (Winter 1998): 33.

¹⁰⁵ Ibid.

¹⁰⁶ Ibid., 33–34.

¹⁰⁷ Ibid., 34–35.

¹⁰⁸ Ibid., 35–36.

Brazil. He contends that because all Brazilian state legislatures exist within the same framework of formal intuitions, differences in their electoral markets, which he defines as “the mechanisms and patterns whereby voters and candidates exchange votes and policy options,” may highlight societal variables throughout the country.¹⁰⁹ Electoral markets exist on a spectrum ranging from clientelistic systems (in which votes are exchanged for private goods or cash) to programmatic systems (in which votes are exchanged for policy promises) with Desposato demonstrating the variance of Brazil’s electoral markets through a study of the legislative behavior between its poorest state (Piauí) and its richest state (São Paulo).¹¹⁰

His findings in Piauí match much of what I have previously discussed in relation to the incentives produced by Brazil’s formal intuitions. Within state legislatures, Desposato discovers that vote buying is a common occurrence with politicians in Piauí providing local public or private goods (which can include access to private doctors, medicine or jobs) in return for votes, with some instances of direct vote purchasing.¹¹¹ Furthermore, for one state deputy, building a road in his district was not sufficient to gain reelection, his constituents demanded private goods.¹¹² Because Brazil’s federal system provides governors significant control over state budgets, Piauí’s clientelistic electoral system encourages legislators to exchange outright support of the governor’s programs (even when he is a member of the opposition party) for access to the state’s budget in order to provide both public and private goods to supporters, undermining party cohesion.¹¹³

In contrast, São Paulo presents a much more diverse electoral market with a stronger tendency towards the programmatic. While vote buying and clientelistic relationships do exist in some areas, it is less pervasive overall, with constituents rewarding legislators for providing better policies alongside public goods. Furthermore,

¹⁰⁹ Desposato, 59

¹¹⁰ Ibid., 59–60.

¹¹¹ Ibid., 62.

¹¹² Ibid.

¹¹³ Ibid., 64.

party loyalty is stronger, with the opposition remaining more cohesive and the legislature as whole more prepared to bargain with the executive over policies than to compete for access to the budget.¹¹⁴

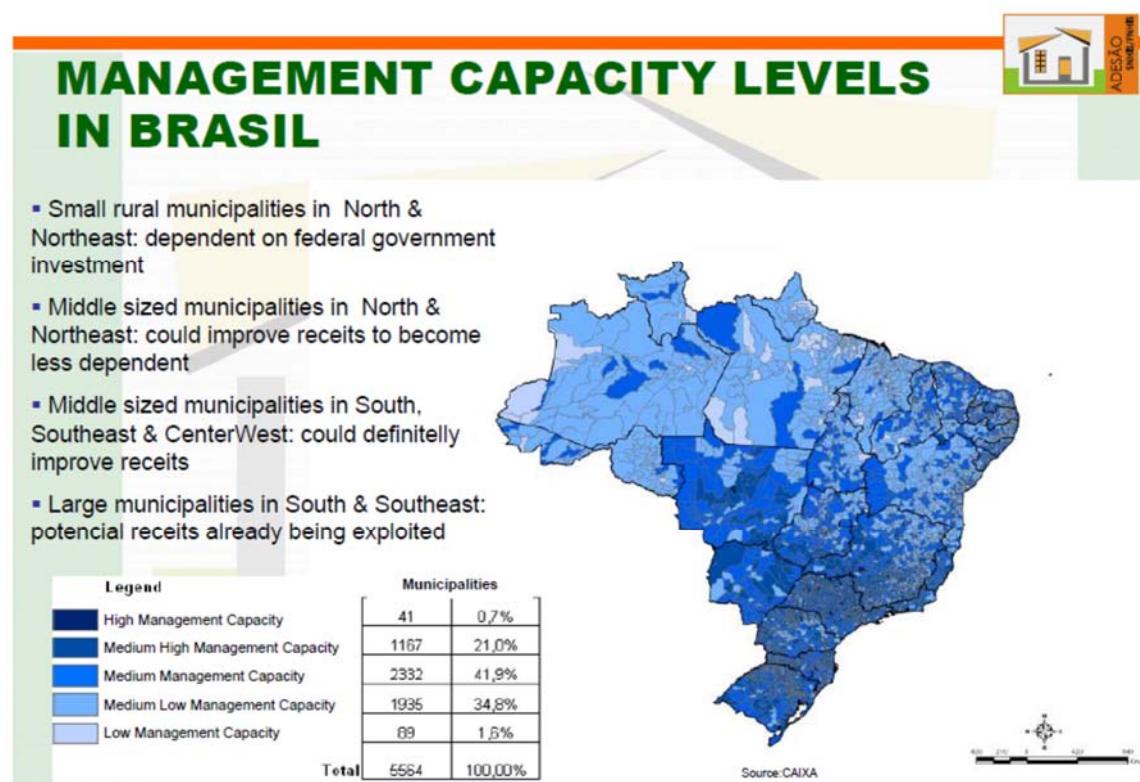
Consistent with this general pattern of patronage, Selcher provides some insightful statistics on public employment as a percentage of the total registered workforce across Brazil in the 1990s. Poorer regions had the highest percentage: 39 percent in the North, 34 percent in the Northeast, 30 percent in the Center West; compared to wealthier regions: 20 percent in the South and 18 percent in the Southeast.¹¹⁵ He specifically notes that the public sector in Piauí employs 52 percent of the registered workforce; higher than even the capital, Brasília, with 48 percent.¹¹⁶ Similarly, a look at the management level capacity across Brazil's municipalities presented to the World Bank in 2009 and displayed in Figure 15 highlight that the poorer, more rural states of Brazil's North and Northeast have the lowest management capacity levels and a heavy reliance on federal government investment. Added to Desposato's significant correlation between clientelistic electoral markets appearing in poor, underdeveloped areas and programmatic markets appearing in more developed environments, the combined result of Brazil's formal and informal political institutions is that poorer, less developed, and less populated states are significantly overrepresented in the national congress by personalistic politicians who have more loyalty to their state and governor than their party, supporting a clientelistic electoral system over a programmatic one.

¹¹⁴ Ibid., 63–67.

¹¹⁵ Selcher, 30–31.

¹¹⁶ Ibid.

Figure 15. Brazil: Management Capacity Levels by Municipality¹¹⁷



Furthermore, the dramatic increase in constitutionally mandated tax transfers from the federal government to municipalities, with poorer states receiving the largest relative share, it should come as no surprise that public investment in general and infrastructure investment in particular has declined as both decentralization and disproportionate representation have increased since the late 1980s. Finally, with municipalities gaining a larger responsibility for local infrastructure provision but lacking some capacity to manage investments, it seems logical that projects have evolved in a piecemeal fashion with few linkages or overall integration into a national plan leading to lower overall quality and access, especially in the transportation sector.

¹¹⁷ Anaclaudia Rossbach, "Brail's Growth Acceleration Program—PAC: Growth with Social Inclusion" (presentation, World Bank Urban Week, March 2009), <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1235146842675/5848984-1237338325293/Rossbach.pdf>.

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IV. BRAZIL'S POLICIES AND POLITICIANS

How have Brazil's formal and informal institutions directly contributed to broader economic policies related to its infrastructure investment? In this chapter, I will show that the shift to fiscal and political decentralization beginning in the 1980s combined with an electoral system supporting clientelistic electoral markets and led to procyclical public spending and investments that have also corresponded with federal election cycles. Additionally, different presidential administrations have shown a degree of variation in their approaches to infrastructure investment, falling along ideological lines and resulting in inconsistent levels of both public and private investment. While these trends do appear to have subsided since the early 2000s, several challenges still exist for Brazil; not only to increase infrastructure investment but also to increase of effectiveness and efficiency of each investment.

A. PROCYCLICALITY

Summarizing prevalent voices in the debate, Sturzenegger and Werneck emphasize that, as economic situations improve weak governments give into political pressure to increase spending and decrease taxes.¹¹⁸ Furthermore, they rationalize the proclivity to procyclicality by a strong incentive for groups to secure their share of new economic spoils before competing groups can. Unlike developed countries that tend towards procyclical taxing and countercyclical spending, developing countries in general (and Latin America in particular) display stronger procyclical tendencies in both taxing and spending.¹¹⁹ Moreover, Sturzenegger and Werneck examine the procyclicality of recent spending among Brazil's subnational governments and conclude that subnational spending—particularly at the state-level—shows a noticeable degree of procyclicality, which does not stem from federal transfers, but instead comes from tax revenue that subnational governments collect directly.¹²⁰ They attribute the declining levels of

¹¹⁸ Sturzenegger and Werneck, 145.

¹¹⁹ Ibid.

¹²⁰ Ibid., 169.

procyclicality among Brazil's subnational governments to broad fiscal adjustment efforts to reschedule state debt in the late 1990s, and culminating in the 2000 Fiscal Responsibility Law that significantly constrained state payrolls, budget limits, borrowing, and debt levels; required greater transparency of public accounts; and established financial, legal, and electoral penalties to mayors and governors guilty of mismanagement or noncompliance.¹²¹

Data related to the evolution of policy responses in times of financial crises in Latin America supports Brazil's recent trends towards countercyclical economic policies. While not directly measuring evolution over time, Vegh, and Vuletin compare two distinct periods and find that, “*on average*, Latin America's fiscal and monetary policy responses to crises have shifted from being procyclical before 1998 to being countercyclical after 1998.”¹²² Brazil, which like Argentina saw the largest number of crises (seven) over their 40-year dataset, emerged not just with clear countercyclical fiscal and monetary policy responses in times of crises, but the frequency of crises post-1998 declined as did their duration and intensity.¹²³ Moreover, Frankel, Vegh, and Vuletin address the political economy determinants of cyclicity and show that, in more democratic regimes where the returns on rent-seeking are expected to be lower, “stronger checks and balances decrease the degree of procyclicality of fiscal policy,” and that institutional quality is a significant factor when it comes to determining fiscal cyclicity with stronger institutions supporting countercyclical policies.¹²⁴ While they do not directly address Brazil in this case, the shift towards more countercyclical policies could be evidence of increasing institutional quality, although that is not supported by the WEF ranking found in Table 1. It may instead reflect convergence along a general acceptance of what appropriate fiscal and monetary policies should be, regardless of the political

¹²¹ Ibid., 151–152, 169.

¹²² Carlos A. Vegh and Guillermo Vuletin, “The Road to Redemption: Policy Response to Crises in Latin America,” *NBER Working Paper No. 20675* (Cambridge, MA: 2014), 5.

¹²³ Ibid., 7–10.

¹²⁴ Jeffrey A. Frankel, Carlos A. Vegh, and Guillermo Vuletin, “On Graduation from Fiscal Procyclicality,” *Journal of Development Economics* no 100 (2013): 39.

implications; it may even be a result of the dataset's timing, coinciding with the gains of commodity supercycle that have recently come to an end.

B. ELECTORAL CYCLES

Looking specifically at the extent to which Latin American governments expand their fiscal expenditures around elections in order to attract voters, Nieto-Parra's and Santiso's empirical evidence shows that between 1990 and 2006, Latin American countries did alter their fiscal policy around elections when compared to OECD countries, increasing current expenditures by nearly 0.8 percent of GDP during an election year while increasing capital expenditures more than 0.3 percent of GDP in the year prior to an election.¹²⁵ When compared to OECD countries that made minimal changes to their current and capital expenditures during election years (with both increasing less than 0.1 percent of GDP), Latin America's trends appear more significant as primary expenditures account for a smaller percentage of GDP in Latin America (22 percent) than in OECD countries (40 percent).¹²⁶ Furthermore, Nieto-Parra and Santiso suggest that voters observe the impact of capital expenditures in the year prior to elections as investments in public goods such as infrastructure whereas, in the election year, they observe current expenditures as social transfers, usually offset by reductions in government investment.¹²⁷

Of course, there is considerable variation throughout the region, but this where Brazil stands out as having the highest change in primary expenditures of the 19 Latin American countries observed. Variations over time are factors as well with Nieto-Parra and Santiso calculating that both primary and capital expenditures were more important in the 1998 reelection of president Fernando Henrique Cardoso (1.7 and 5 percent of GDP, respectively) than in the 2002 election of Luiz Inácio Lula da Silva (0.1 and 0.9 percent of GDP, respectively) in which candidates agreed to responsible fiscal

¹²⁵ Sebastián Nieto-Parra and Javier Santiso, "Revisiting Political Budget Cycles in Latin America," *OECD Development Centre Working Paper No. 281* (Paris: OECD, 2009): 11.

¹²⁶ *Ibid.*, 11–12.

¹²⁷ *Ibid.*, 15.

commitments prior to the election.¹²⁸ While it is difficult to see a direct impact to Brazil's public infrastructure investment levels in those two elections (see Figure 16), the data suggests that not only do Brazilian political institutions place a substantial emphasis on increasing both public goods (capital expenditures in the year prior to an election) and private goods (current expenditures in the election year), but that political elites have substantial flexibility in altering government expenditures in order to achieve personal political goals. An examination of the actions of across different presidential administrations supports that conclusion as well.

C. LEADERS, IDEOLOGY, AND PRIVATIZATION

One way in which we can observe variations in infrastructure investment over time in Brazil is across presidential administrations that cut along ideological lines. In a recent article, Armijo and Rhodes contend that Brazil's differing ideological approaches—the center-right (Presidents Cardoso and Temer, who “focus on improving competition, macroeconomic stability, neutral and consistent regulatory oversight, and, more generally, the investment environment for private business”) and the center-left (Presidents da Silva and Rousseff, who “instead prioritized escaping commodity dependence and the middle-income trap through a state-led big push to mobilize investment in technological innovation and large-scale infrastructure”)—represent two differing approaches to infrastructure investment in Brazil.¹²⁹

Beginning with Fernando Henrique Cardoso's administration which, coming to power in 1995 and marking Brazil's first democratic transition of presidential power since the military coup that ousted President João Goulart in 1964, had a goal to regain macroeconomic credibility in the wake of the 1980s debt crisis stressed public spending discipline, a private-sector driven approach, and implemented several regulatory and oversight bodies within each infrastructure sector.¹³⁰ Over the 1990s, privatization raised \$87 billion (the most of any developing country) with most of it occurring in the

¹²⁸ Ibid., 13, 16.

¹²⁹ Armijo and Rhodes, 233.

¹³⁰ Ibid., 234, 243.

telecommunications sector followed by mixed public and private ownership in electricity and transportation and most state and municipal governments retaining ownership of urban infrastructure.¹³¹ These observations parallel the public-private and sectoral breakdown presented in Figure 16. Moreover, where privatization did occur, Armijo and Rhodes note that the results were impressive with services improving and becoming more efficient. Unfortunately, total infrastructure investment did not increase and the regulatory apparatus failed to function as intended with government still playing a significant role in project design, selection, financing, and providing long-term guarantees to investor, effectively subsidizing private-sector profits.¹³²

President Luiz Inácio Lula da Silva (2003-2010), who favored the developmental state approach in that he viewed government in a better position than the private sector to provide for the public good, interestingly retained Cardoso's macroeconomic policy in his first term although he expanded social programs and implemented a growth strategy that emphasized innovation and tax breaks for exports.¹³³ His second term saw the implementation of the four-year infrastructure Growth Acceleration Program (*Programa de Aceleração do Crescimento*, or PAC) that launched in 2007 and focused on “mega-projects” in energy and transportation related to the 2014 World Cup and 2016 Olympics.¹³⁴ In total, the Brazilian government expected PAC to invest 503.9 billion Reals in the four years of the program.¹³⁵ And, as Figure 16 shows, while both public and private infrastructure investment did decline in at the beginning of da Silva's first term, public investment steadily increased and private investments reached its peak, albeit with some volatility.

¹³¹ Ibid., 234.

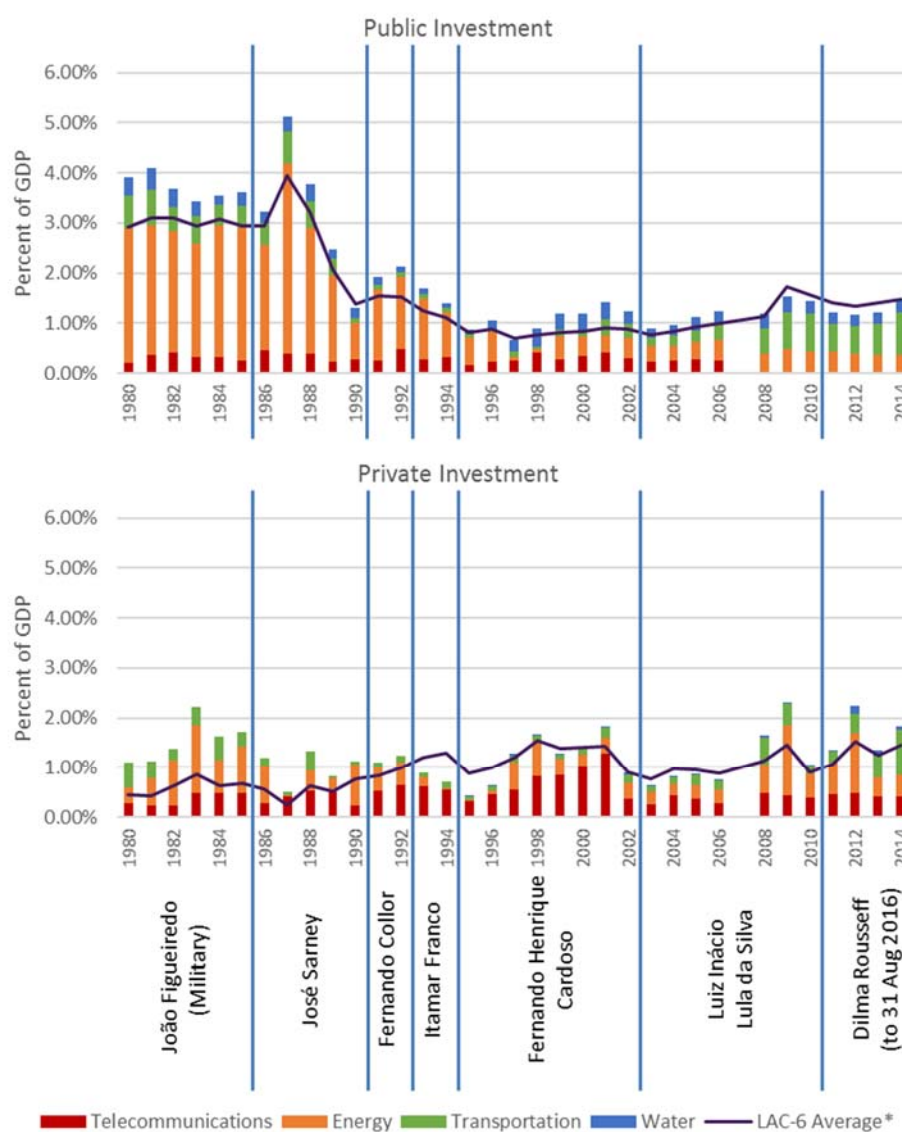
¹³² Ibid., 242–243.

¹³³ Ibid., 234.

¹³⁴ Ibid., 234, 242.

¹³⁵ Ana Paula Ribeiro and Patrícia Zimmermann, “Com PAC, Governo Espera Investimento de R\$ 504 bi até 2010,” *Folha de São Paulo*, January 22, 2007: <http://www1.folha.uol.com.br/folha/dinheiro/ult91u113888.shtml>.

Figure 16. Brazil: Public and Private Infrastructure Investment by Presidential Administration¹³⁶



*GDP-weighted average. 2007 data not available.

Upon taking office, President Dilma Rousseff (2010-2016) implemented President da Silva's follow on, PAC 2 program as Brazil saw impressive economic growth at the end of the 2000 decade. Estimated investments for the 2011–2014 PAC 2

¹³⁶ Adapted from Calderón and Servén, "Infrastructure in Latin America" and Infralatam Database.

lifespan totaled 958.9 billion Reals (\$526 billion) with energy investments representing nearly 49 percent of the total, followed by housing at 29 percent, transportation at 11 percent, and water at 3 percent, among other things.¹³⁷ However, as Brazil's growth began to slow, several projects never left the planning stage and the 2014 *Lavo Jato* (Car Wash) scandal broke, "laying bare an enormous corruption scheme in which most of Brazil's premiere construction firms...were revealed to have paid kickbacks for infrastructure projects."¹³⁸ Of note, under the center-left period, urban transportation shifted to a model in which Brazilians began to abandon public transportation for private cars and motorcycles as they became relatively cheaper, disproportionally affecting the poor who relied on public transport and resulting in waves of protest against the high cost and low quality of urban infrastructure.¹³⁹ Overall, while both da Silva and Rousseff were successful at increasing infrastructure investment, they "had enormous problems with wasteful spending, cost overruns, and never-completed mega-projects—not to mention corruption."¹⁴⁰

Following Rousseff's impeachment in August 2016, the center-right Michel Temer quickly addressed problems of public finance and infrastructure management.¹⁴¹ Additionally, his government implemented an Investment Partnership Program (*Programa de Parcerias de Investimentos*, or PPI) secretariat within the presidential office to promote private investment in infrastructure and began to decrease the role of Brazil's publically owned national development bank (BNDES) as the main lender in public-private partnerships in an effort to diversify capital markets.¹⁴² Moreover, President Temer and PPI Executive Secretary, Willington Moreira Franco, overhauled a logistics investment program from the Rousseff administration, transferring some of the

¹³⁷ Ihssane Loudiyi, "Brazil Announces Phase Two of the Growth Acceleration Program," March 30, 2010: <http://blogs.worldbank.org/growth/brazil-announces-phase-two-growth-acceleration-program>.

¹³⁸ Armijo and Rhodes, 235.

¹³⁹ Ibid., 239.

¹⁴⁰ Ibid., 242.

¹⁴¹ Ibid., 235.

¹⁴² The Economist Intelligence Unit, *The 2017 Infrascope: Evaluating the Environment for Public-Private Partnerships in Latin America and the Caribbean* (New York, NY: The Economist Intelligence Unit, 2017), 19.

projects into a new infrastructure concession program known as *Projeto Crecer* in which 11 of the 25 total projects are in the transportation sector, “including four airports, three railways, two highways, and two port terminal concessions.”¹⁴³ In fact, Moreira Franco directly addressed the past role that politics played infrastructure investment stating, “The decisions that were made previously in the infrastructure sector were very dependent on political options...If you built a railroad, it wasn’t because you were helping to transport a product but because of a political decision. Now, when you see the proposed concessions from the transportation ministry, they are linked to the transportation of goods and products.”¹⁴⁴

In their evaluation of public-private partnerships (PPPs) across Latin America and the Caribbean, the Economist Intelligence Unit (EIU) describes President Temer’s creation of the PPI secretariat and reduction of the role of BNDES as two significant institutional changes for Brazil.¹⁴⁵ In fact, when looking at their findings, Brazil’s market size, strong institutional framework, and its ability to execute PPPs at national and subnational levels have all led to Brazil being responsible for close of half of all PPP projects undertaken in the region.¹⁴⁶ However, the EIU does identify three distinct challenges for Brazil moving forward. First is getting both foreign and domestic commercial banks and institutional investors to fill the financing gap left by BNDES. Second—and similar to the lower management capacity within some of Brazil’s municipalities—is a lack of proficiency and technical capacity at the local level that is becoming increasingly critical as subnational governments play a greater role in the complex process of PPP contracting in new and diverse infrastructure sectors. Third, corresponding to the corruption cases recently plaguing the infrastructure market, Brazil

¹⁴³ Mick Bowen, “Brazil says markets, not politics, will drive infrastructure investments,” *Latin Finance*, September 28, 2016: http://www.latinfinance.com/web-articles/2016/9/brazil-says-markets-not-politics-will-drive-infrastructure-investments#.WclSL_4ksy8.

¹⁴⁴ Wellington Moreira Franco, quoted in *Ibid.*

¹⁴⁵ The Economist Intelligence Unit, 19.

¹⁴⁶ *Ibid.*, 8.

must further enhance PPP transparency and accountability standards in an effort to drive competitiveness and efficiency.¹⁴⁷

Currently, the infrastructure investment data does not exist to show the relative levels or outcomes of what appears to be a renewed emphasis on private infrastructure investment in Brazil consistent with Armijo's and Rhodes' characterization of the center-right ideological approach. However, the variation in policies implemented over several presidential administrations that reflect ideological differences point to the lack of constraints that political institutions place on presidents. In fact, Armijo and Rhodes argue that because Brazil's political institutions encourage incoming administrations to distribute favors in order to build coalitions, policy predictability is low, impeding both effectiveness and efficiency.¹⁴⁸ Given Brazil's levels of both public and private investment across infrastructure sector when compared to the rest of the region, its underperformance in terms of quality, quantity, and access (especially in the transportation sector) does support the argument that lower effectiveness and efficiency has resulted from greater investment volatility and insufficient managerial and technical capacity, partly due to a lack of private participation. Moreover, these interim factors all stem from political incentives—shaped by the combined effects of Brazil's political and fiscal decentralization and its electoral markets—which have disproportionately distributed revenue to smaller, rural, and poorer municipalities that tend to support inefficient clientelistic networks.

¹⁴⁷ Ibid., 19.

¹⁴⁸ Armijo and Rhodes, 241.

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V. CONCLUSIONS

A. OBSERVATIONS

In this thesis, I have attempted to draw the link between infrastructure investment and development in Latin America through an examination of the roles that institutions, policies, and the leadership of politicians have all played in Brazil. I hypothesized that the countries that maintain effective investment-supporting institutions, implement appropriate economic policies, and place their trust in individuals with the capacity and willingness to make prudent choices should not only increase public and private infrastructure investment through various economic conditions; the effective and efficient use of their resources should be visible through measured improvements across their infrastructure quality, quantity and access. My initial reasoning was that the combined effects of robust and supportive institutions, proper policies, and disciplined leaders should support governments in: maintaining higher levels of public infrastructure investment, reinforcing the crowding-in effect that public funds can have on private investment, avoiding the anti-investment bias during times of fiscal consolidation, all while maintaining sufficient prioritization and oversight to ensure the effective and efficient use of resources. Ultimately, this should provide more access to higher quality infrastructure services, capitalize on the future growth potential of infrastructure, increase development and competitiveness, while freeing up additional resources to support programs that promote higher levels of equality.

While the effectiveness and efficiency of Brazil's public and private infrastructure investments are difficult variables to measure independently, I was able to gauge their overall trends by examining the level of Brazil's infrastructure development relative to investments. I then compared the effectiveness and efficiency of Brazil's infrastructure investments to its institutions, policies, and leadership to determine the effect of each variable on infrastructure development in general. While difficult to quantify, I have arrived at the following conclusions.

Brazil's formal and informal political institutions have had the greatest impact on both infrastructure investment and development. The military dictatorship that first dismantled state- and party-based political structures while preserving municipal elections, gave way to state elections prior to federal ones in the first steps of the democratic transition leading to an increase of political power and influence for subnational governments relative to the federal government. At the same time, the process of fiscal decentralization—continuously reinforced by local politicians from the bottom-up—increased the revenue of municipal governments and left them with a mandate for providing public services, ultimately giving local leaders an unprecedented level of political and fiscal autonomy and responsibility in public infrastructure investment. Added to an electoral system that continues to encourage personalistic behavior, Brazil's poorer and less populated states—simultaneously displaying the lowest levels of management capacity while receiving disproportionately greater amounts of political representation at the federal level and greater shares of federal tax transfers—have supported clientelistic electoral markets resulting in less programmatic investments, decreasing the overall effectiveness and efficiency of public spending. Moreover, 13 years of the developmental state approach pursued by Presidents da Silva and Rousseff have not only led to lower levels of private infrastructure investment, but have also prevented the improvement of managerial and technical capacity levels that private participation can provide to the infrastructure sector.

Of the three independent variables that initially formed my hypothesis (institutions, policies, and leadership), what emerges is the central role that institutions have played throughout infrastructure investment and development in Brazil. Despite differing ideologies across various presidential administrations, Brazil's current macroeconomic policies have emerged more countercyclical as the Fiscal Responsibility Law constrained subnational payrolls, budgets, borrowing, and debt, required greater transparency, and established penalties for noncompliant politicians. Therefore, while the leadership and discipline of politicians shape the policies that impact on infrastructure in Brazil, they can be thought of more as intervening variables, determined by the underlying incentives and constraints that are in turn shaped by the country's formal and

informal institutions—leaving us with institutions at the center of this discussion on infrastructure investment and development.

As inadequate and insufficient infrastructure continues to contribute to low productivity, and weak economic growth—not only in Brazil, but across all of Latin America—understanding the root causes underlying infrastructure gaps continues to remain as vital today as it has at any time. For that reason I turn to two additional cases, Mexico (with the lowest average annual infrastructure investment levels among LAC-6, but second in terms of infrastructure quality) and Chile (with the highest levels of both infrastructure investment and quality in LAC-6), to see if I can draw a preliminary link between those countries’ institutions and their varying levels of infrastructure investment and development.

B. ADDITIONAL CASES

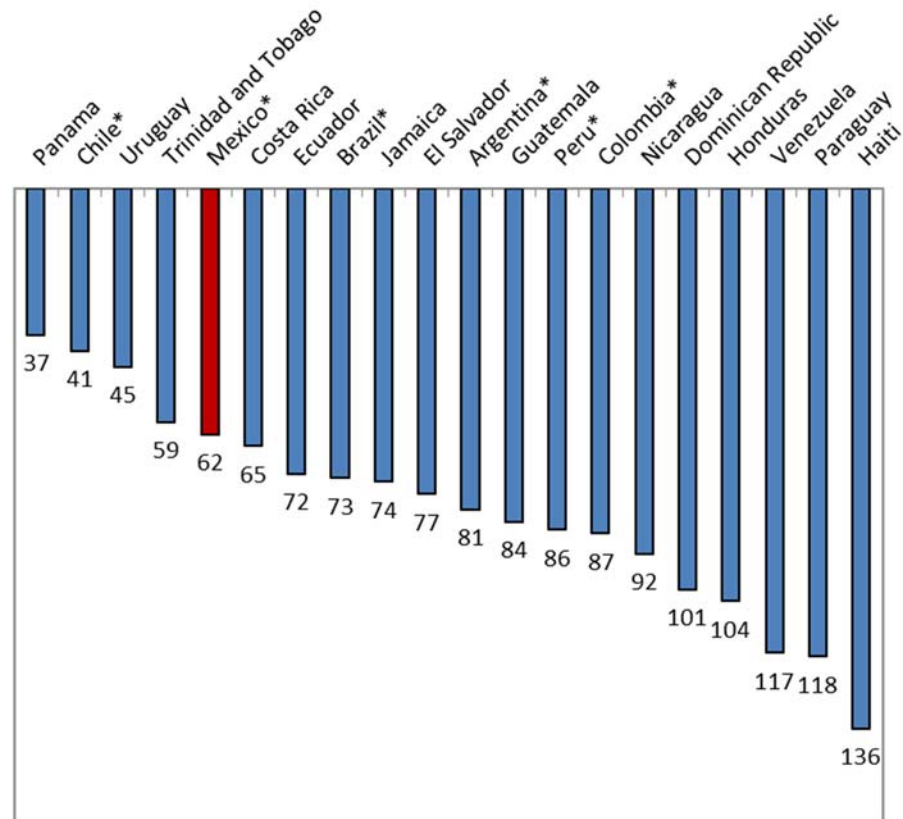
1. Mexico

a. Infrastructure Trends

A look at the WEF ranking of Mexico’s infrastructure compared to other Latin American countries in Figure 17 provides a first cut. While Mexico performs quite well when compared to both its regional neighbors and LAC-6, its global ranking reveals a more nuanced picture. With an infrastructure ranking of 62 out of the 137 countries surveyed, Mexico’s position less represents the weight of the world’s 15th largest economy (with a 2016 GDP valued at over \$1 trillion), and more its lower GDP per capita (67th in the world as of 2016); lower than Trinidad and Tobago, Uruguay, Chile, and Panama—all of which also perform better than Mexico in the WEF rankings.¹⁴⁹

¹⁴⁹ The World Bank, World Development Indicators.

Figure 17. Mexico: WEF Infrastructure Rank, 2017¹⁵⁰



1 = Best, 137 = Worst. *LAC-6 Countries.

Breaking down the WEF's ranking into some of its constituent categories in Figure 18 reveals some noteworthy sectoral trends as well. First, most of the rankings more or less reflect Mexico's overall infrastructure rank with two exceptions: the quality of roads (in which Mexico achieves its best ranking in the category) and mobile telephone subscriptions, where Mexico comes in at a disappointing 108 out of 137 countries surveyed. Second, most of the rankings remain relatively constant over the data's 11-year timespan; again with a few exceptions: both the relative quality of Mexico's port infrastructure and its electricity supply have increased while mobile telephone subscriptions have dropped remarkably. Considering that these are relative rankings, the drop in rank for Mexico's mobile telephone subscriptions since 2007

¹⁵⁰ Adapted from WEF GCI Dataset 2006–2017.

reflects Mexico's inability to keeping pace with the rest of the world in this sub-category. Similar trends are present in indicators of Mexico's internet penetration. Diving a little deeper into the telecommunications sector—with 12.67 fixed broadband subscriptions per 100 people as of 2016—Mexico is 90th the world, although it beats the LAC average of 11.207.¹⁵¹ Those subscriptions translate to 59.54 percent of the Mexican population using the internet as of 2016; again, 90th in the world and better than the Latin American and Caribbean average of 56.34 percent.¹⁵²

That level of access, however, conceals wide variation across Mexico and, while state-by-state breakdowns of both internet penetration and access to telecommunications infrastructure are difficult to come by, anecdotal evidence supports that assertion. Reuters recently reported that even though the country does not publish official statistics on the percentage of the population with little or no phone access, and the World Bank has concluded, “Mexico has the most unequal access to cellphone coverage in Latin America.”¹⁵³ With the lowest broadband penetration rates in the OECD, PricewaterhouseCoopers correlates one factor of internet penetration and usage in Mexico it poverty.¹⁵⁴ Moreover, the OECD estimated that, as of 2012, “the welfare loss attributed to the dysfunctional Mexican telecommunication sector is estimated at USD 129.2 billion (2005-2009) or 1.8 percent of GDP per annum.”¹⁵⁵ With a relatively high rural population, the OECD argues that in order to increase productivity and economic growth, Mexico needs greater access to higher quality communications services.¹⁵⁶

¹⁵¹ The World Bank, World Development Indicators.

¹⁵² Ibid.

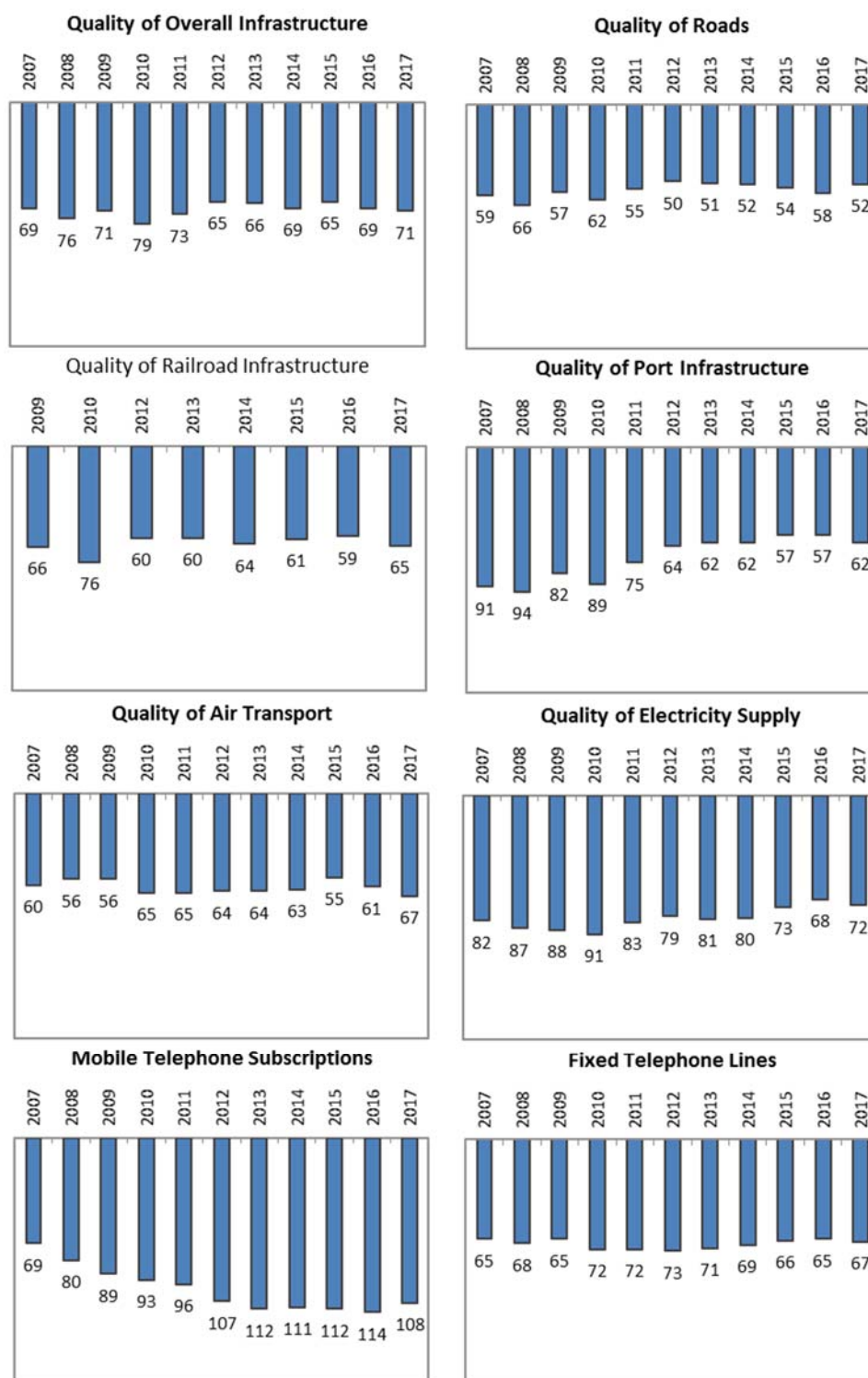
¹⁵³ Christine Murray, “As Mexico Lauds Telecom Reform, Rural Poor Search for Connection,” Reuters, last modified October 26, 2016, <https://www.reuters.com/article/us-mexico-telecoms/as-mexico-lauds-telecom-reform-rural-poor-search-for-connection-idUSKCN12R0HH?il=0>.

¹⁵⁴ PricewaterhouseCoopers Mexico, “Overview of the Telecommunication Sector in Mexico: Fixed and Mobile Lines,” February 2015, <https://www.pwc.com/mx/es/knowledge-center/archivo/2015-03-kc-telecommunication-sector-in-mexico.pdf>, 9.

¹⁵⁵ OECD, *Review of Telecommunication Policy and Regulation in Mexico* (Paris: OECD Publishing, 2012), <http://dx.doi.org/10.1787/9789264060111-en>.

¹⁵⁶ Ibid.

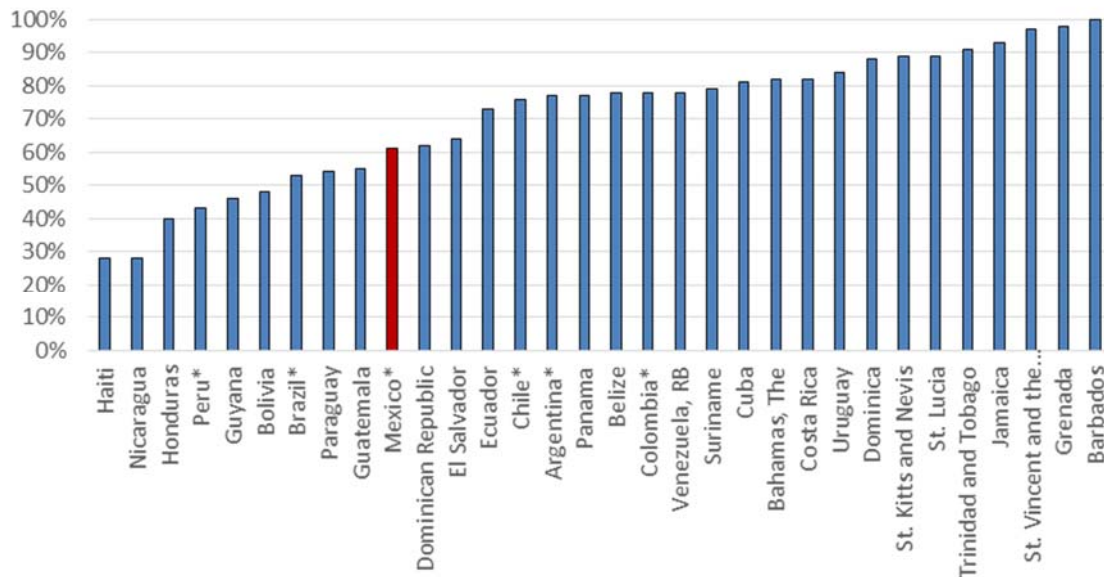
Figure 18. Mexico: WEF Infrastructure Quality Indicators, 2007–2017¹⁵⁷



¹⁵⁷ Adapted from WEF GCI Dataset 2006–2017.

Although indicators of infrastructure access in other sectors reflect better performance, Mexico still has room for improvement. With 61 percent of its population living within two kilometers of an all season road, Mexico's population has better access to its transportation infrastructure than Brazil or Peru, but less than Chile, Argentina, and Colombia (see Figure 19). Nonetheless, Figure 20 shows that Mexico has consistently outperformed the regional average in terms of the percentage of its population with access to electricity. Additionally, in the late 1990s, Mexico surpassed the LAC average for the percentage of its rural population with access to both improved water and improved sanitation with increased access by its urban population bringing total levels above the regional average in the early- to mid-2000s.

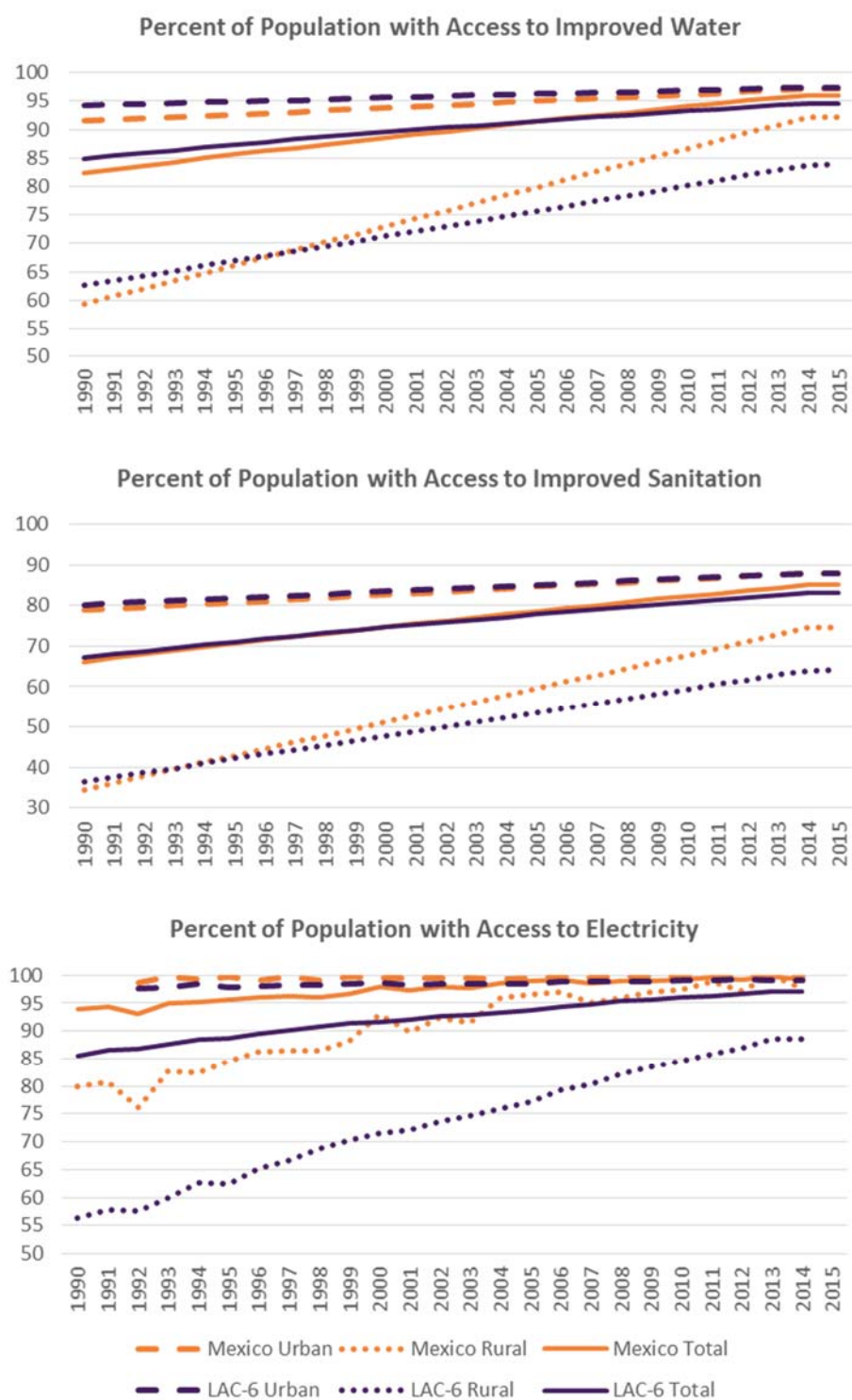
Figure 19. Mexico: Rural Access Index, 1999–2004 Data¹⁵⁸



Percentage of rural population living within 2 kilometers of an all-season road. *LAC-6 Countries. Mexico's data is from 2003.

¹⁵⁸ Adapted from World Bank, Rural Access Index.

Figure 20. Mexico: Infrastructure Access Indicators, 1990–2015¹⁵⁹

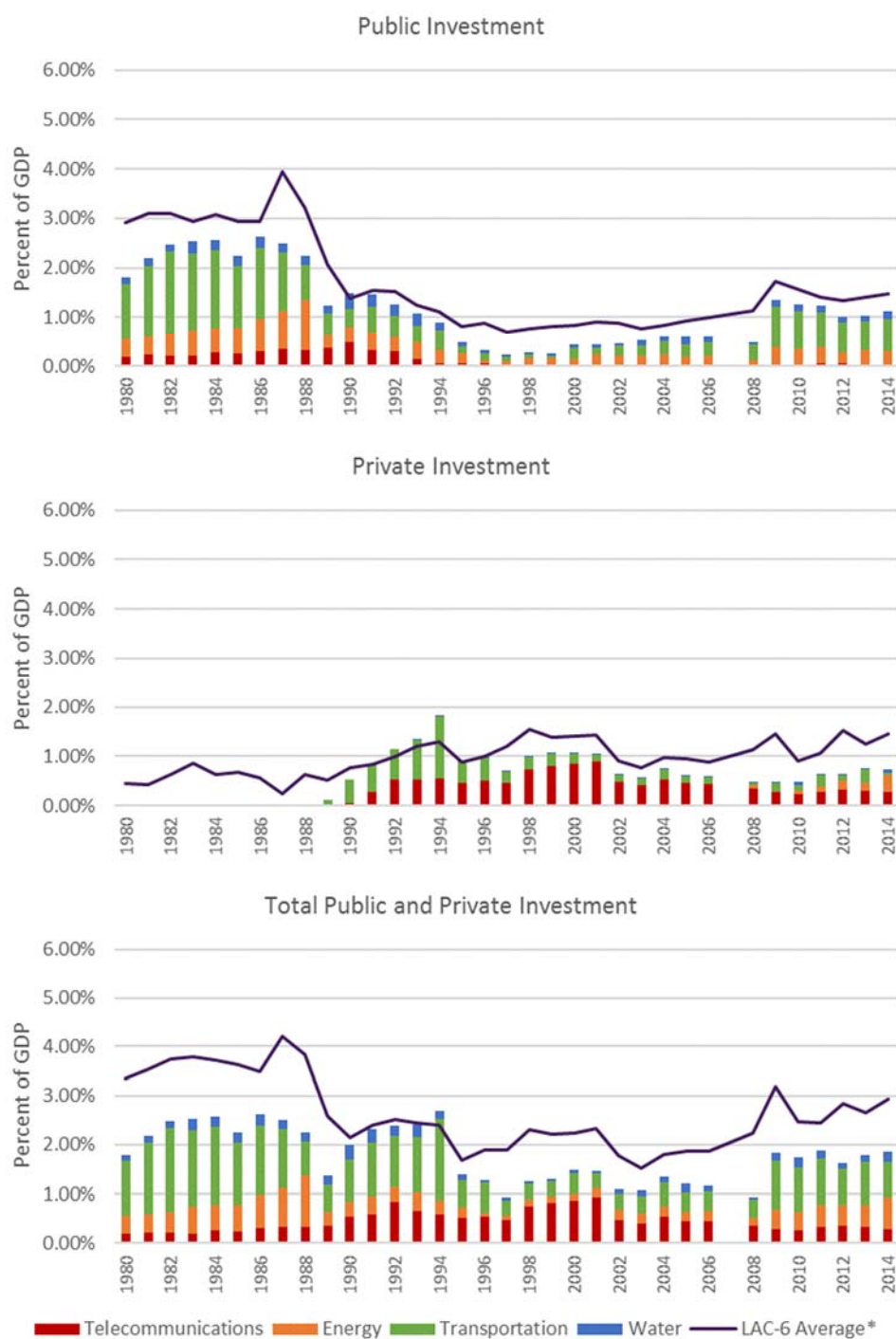


¹⁵⁹ Adapted from World Bank, World Development Indicators.

b. Infrastructure Investment Levels

Turning to infrastructure investment, we can see that the underperformance and unequal access of Mexico's telecommunications infrastructure when compared to other countries in the region as well as to other infrastructure sectors within Mexico directly correlates to public and private infrastructure investment levels since 1980. First, Figure 21 and Figure 22 show that, in terms of public investment, the Mexican government has not only spent less on overall infrastructure as a percentage of its GDP than the weighted average of LAC-6 but, telecommunications represents the smallest target for public investment. Additionally, as the wave of privatization that swept over much of Latin America in the wake of the debt crisis reached Mexico, public investment in telecommunications dropped precipitously. While private investment levels did increase over the same period of time, their average remained below the that of the LAC-6 and, as low levels of quality and access reveal, private investments have clearly not been able to meet the needs of Mexico's population—especially in poorer, more rural areas.

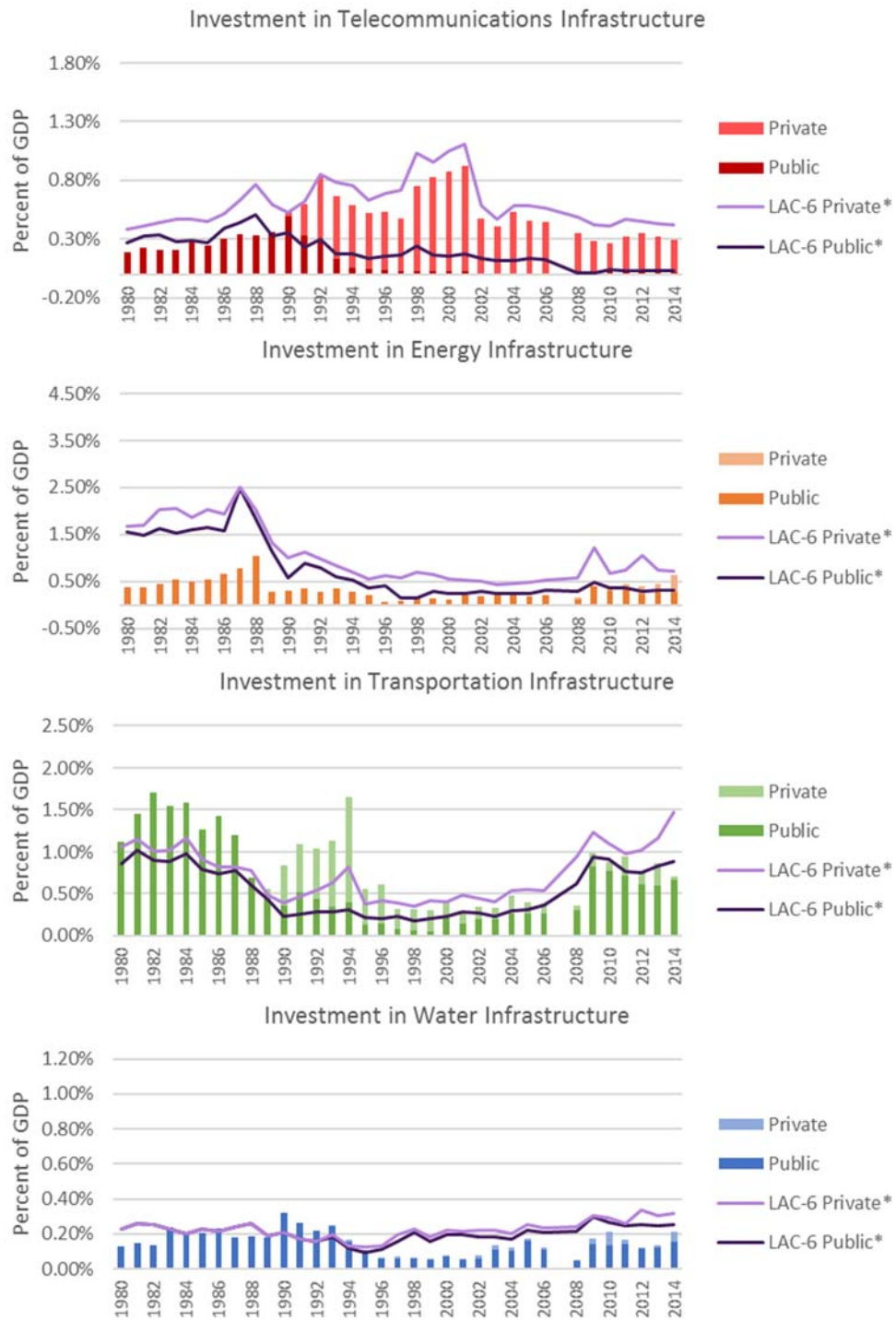
Figure 21. Mexico: Public and Private Investment in Infrastructure, 1980–2014¹⁶⁰



*GDP-weighted average. 2007 data not available.

¹⁶⁰ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

Figure 22. Mexico: Infrastructure Investment by Sector, 1980–2014¹⁶¹



*GDP-weighted average. 2007 data not available.

¹⁶¹ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

c. *Institutional Effects*

Mexico's insufficient investment rates across all infrastructure sectors in general (and in telecommunications in particular) are symptomatic of the political institutions that similar to those in Brazil underwent fundamental transformations in the 1990s. More specifically, as the ruling *Partido Revolucionario Institucional* (Institutional Revolutionary Party, or PRI) lost its grip on power and began to introduce electoral competition, the subsequent increase in the degree of political and fiscal decentralization coincided with increased privatization efforts where, as Levy and Walton state, "the result was a weak regulatory agency easily captured by private monopolies in a context of low transparency."¹⁶²

Langston explains that, bolstered by informal institutions such as the *dedazo*—a system by which the PRI controlled intraparty competition by allowing the sitting Mexican president to choose who would succeed him as the party's candidate in the next noncompetitive presidential election—the PRI maintained its "party-based authoritarian regime" from 1929 until 2000.¹⁶³ However, as Mexico suffered through two economic crises in the 1980s, President de la Madrid, took steps to liberalize the economy and, in doing so, drove a wedge between the core of the PRI and a faction who opposed neoliberal economic reforms. Combined with a change in electoral rules that allowed multi-party coalitions to support a single candidate, the 1988 election of President Carlos Salinas (one of questionable legitimacy in which Salinas secured just over 50 percent of the votes) represented a significant threat to the PRI's hegemony.¹⁶⁴ Moreover, through a synopsis of competing views on the rational choice behind elite decisions in Mexico, Beer highlights that following the economic crises and a decline in legitimacy, the PRI began to allow democratic elections and some degree of opposition party control at the

¹⁶² Santiago Levy and Michael Walton, *No Growth without Equity? Inequality, Interests, and Competition in Mexico* (Washington, DC: World Bank, 2009), 24.

¹⁶³ Joy Langston, "The Birth and Transformation of the *Dedazo* in Mexico," in *Informal Institutions and Democracy: Lessons from Latin America*, ed. Gretchen Helmke and Steven Levitsky (Baltimore, MD: Johns Hopkins University Press, 2006), 143–144.

¹⁶⁴ *Ibid.*, 152–153.

state and local level in order to distract attention and undermine any threats to the party's power at the national level.¹⁶⁵

In this respect, Mexico's democratization—while continuously evolving—reflects a similar pattern as in Brazil, where free and fair local elections preceded those at the federal level. Beer observes that, in the era of PRI-dominated politics their candidates were guaranteed victory and, therefore, local political leaders depended on the support of the national party leadership as opposed to their local electorate, eliminating any incentives for autonomy from the central government.¹⁶⁶ However, as top-down democratization progressed, electoral competition increased at the subnational level, leading “to de facto political decentralization because the introduction of real democratic competition to subnational governments is in essence political decentralization in formerly dominant-party systems such as Mexico's.”¹⁶⁷ Furthermore, as political decentralization made local politicians increasingly responsible to their constituents, it created incentives and bottom-up demands for greater fiscal independence, with Beer's empirical analysis across Mexican states displays that states with greater electoral competition also have greater fiscal autonomy and, as a result, provide their citizens with more public goods.¹⁶⁸ Similar to Brazil, electoral competition at Mexico's subnational level created bottom-up calls for more fiscal decentralization.

Although constitutionally federal, PRI hegemony prior to democratization created a centralized state where local leaders succeeded through loyalty to their party. That degree of centralization may explain why Mexico's public infrastructure investments prior to the 1990s—although lower than Brazil's—have led to comparatively greater infrastructure development through more programmatically effective and efficient projects, as opposed to being a means for individual politicians to garner votes. As the PRI retained its hold on power at the national level, it pushed a privatization effort that

¹⁶⁵ Caroline C. Beer, “Electoral Competition and Fiscal Decentralization in Mexico,” in *Decentralization and Democracy in Latin America*, ed. Alfred P. Montero and David J. Samuels (Notre Dame, IN: University of Notre Dame, 2004), 186.

¹⁶⁶ Ibid., 191.

¹⁶⁷ Ibid.

¹⁶⁸ Ibid., 198.

saw, among other things, ownership and operation of Teléfonos de Mexico (TELMEX) transfer from public to private hands prior to the creation of any regulatory commission, effectively creating a monopoly.¹⁶⁹ Bourguignon and Dessus claim, “The direct effects of monopoly power are well known. Those enjoying such power receive extra income on top of the normal profit rate in the economy, whereas their customers pay a higher price, have less to buy, and possibly obtain goods and services of lower quality than under conditions of perfect competition.”¹⁷⁰

While the privatization of TELMEX did lead to improvements in efficiency, Levy and Walton contend that—instead of resulting in lower prices or better services for its customers—the efficiency gains translated into higher profits for the company.¹⁷¹ Moreover, a 2006 examination of telephone charges by the OECD shows Mexico (with the lowest per capita GDP in the OECD) as having some of the highest charges for services with steep discounts only slightly offset costs to consumers.¹⁷² Levy and Walton argue that TELMEX’s incentives have been shaped by Mexico’s political equilibrium—which they identify as the informal dominance of the executive branch through PRI structures—and characterize it by a high degree of rent seeking and clientelistic service delivery that resulted in reductions in high inequality and wealth concentration.¹⁷³ Moreover, they claim that, as Mexico’s political equilibrium shifted during the transition to democracy, political incentives changed, and politicians began channeling the country’s oil rents away from growth-producing infrastructure investment in order to expand spending of popular social programs.¹⁷⁴ Figure 23 shows just to what degree public investment declined in the waning of the PRI’s presidential dominance, ending with the 2000 election of Vincent Fox.

¹⁶⁹ Levy and Walton, 9.

¹⁷⁰ François Bourguignon and Sébastien Dessus, “Equity and Development: Political Economy Considerations,” in *No Growth Without Equity? Inequality, Interests, and Competition in Mexico*, ed. Santiago Levy and Michael Walton (Washington, DC: World Bank, 2009), 60.

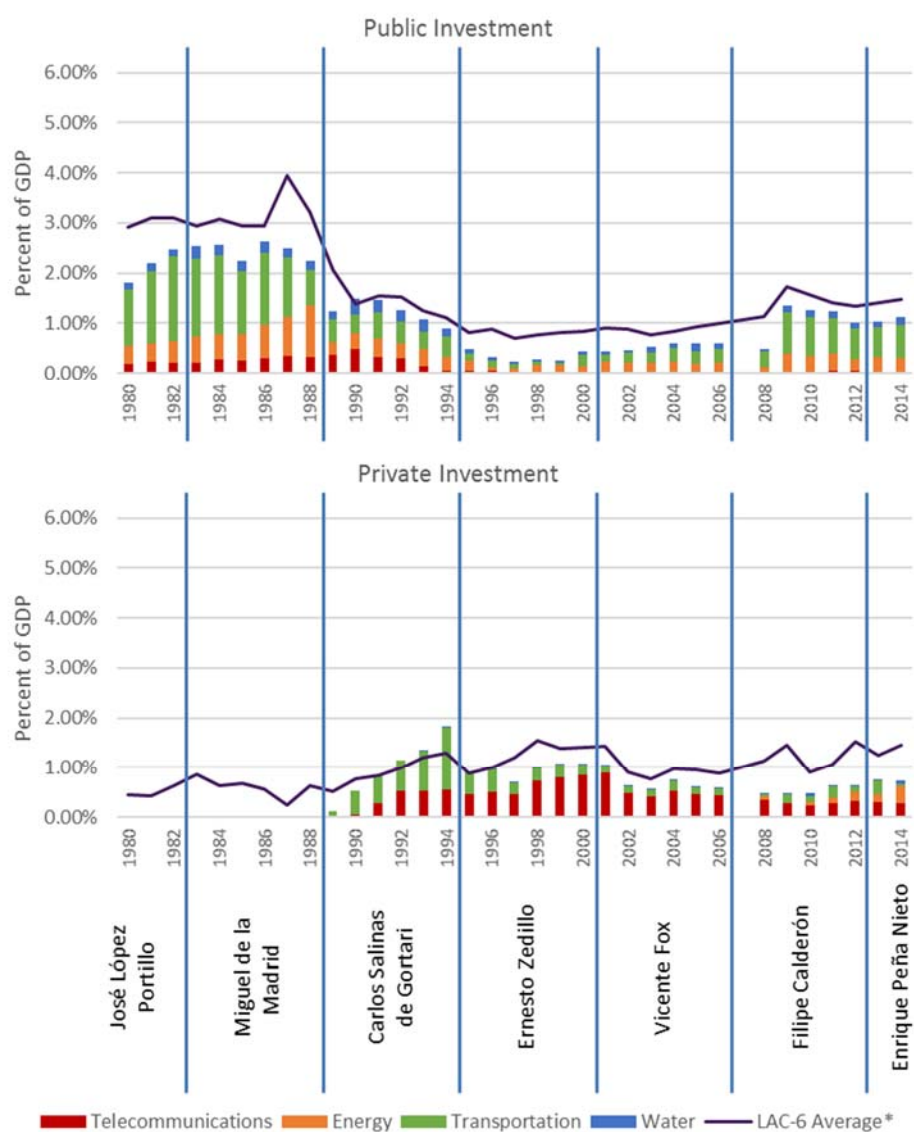
¹⁷¹ Levy and Walton, 35.

¹⁷² OECD, *Review of Telecommunication Policy and Regulation in Mexico*, 9.

¹⁷³ Levy and Walton, 13–14, 20–22.

¹⁷⁴ *Ibid.*, 26.

Figure 23. Mexico: Public and Private Infrastructure Investment by Presidential Administration¹⁷⁵



*GDP-weighted average. 2007 data not available.

As Mexico marched slowly towards democracy, bottom-up pressures for fiscal decentralization combined with increased incentives for social spending resulting in less public infrastructure investment. Additionally, while loosely regulated privatization

¹⁷⁵ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

reduced competition—and with it a drive toward higher quality and wider-ranging infrastructure services (especially in the telecommunications sector)—the monopolies that did emerge were able to create efficiencies, but only in an effort to increase their profits and not to benefit their customers.

Like in Brazil, the political and fiscal decentralization that occurred as part of Mexico’s democratic transition emerges as fundamental in explaining its infrastructure trends. Both Brazil and Mexico held democratic subnational elections prior to federal ones through a process of political decentralization that was controlled from the top-down and both experienced bottom-up pressures for greater fiscal autonomy at the municipal and state levels. Unlike Brazil, however, Mexico’s electoral system resulted in a significantly higher the degree of party loyalty, translating into a highly centralized state despite its constitutionally federal distribution of power. Where Brazil’s personalistic system may have encouraged higher spending by municipal governments in less programmatic ways, the central role that the party played in Mexico’s elections may have led to a weakened relationship between a politician and his or her constituents with the PRI choosing to retain more authority in the public provision of infrastructure as well as the privatization process. The result was less overall infrastructure investment than Brazil, but it came with higher degrees of efficiency and effectiveness, resulting in greater infrastructure development, albeit with plenty of room for improvement.

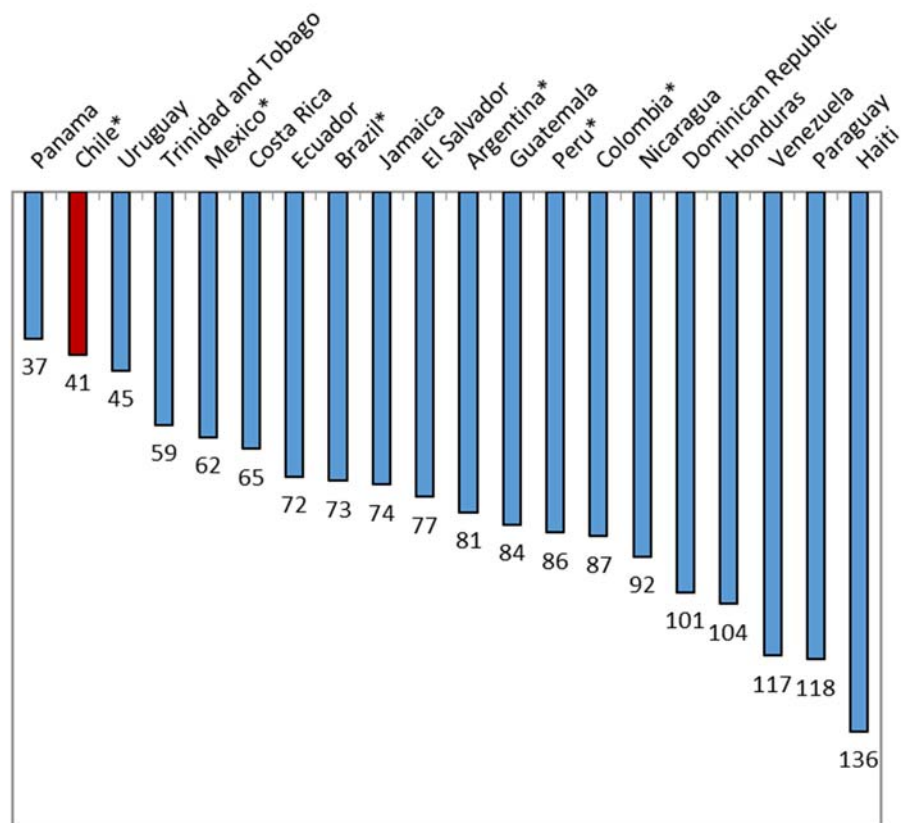
2. Chile

a. Infrastructure Trends

Compared to the rest of Latin America, Chile’s level of infrastructure development presents an exceptional case. Looking at the 2017 WEF ranking in Figure 24, Chile exhibits the best infrastructure among the LAC-6, is regionally second, and 41st in the world. Turning to the WEF indicators of quality shown in Figure 25, Chile’s performance appears even stronger. With a global ranking of 35, Chile has the highest overall infrastructure quality among the Latin American countries surveyed. Combined with even higher rankings in quality of roads, quality of port infrastructure, and quality of electricity supply, these indicators exceed the expectations of the Chile’s world ranking

in terms of GDP per capita (50th in 2016).¹⁷⁶ Although Figure 26 shows that rural access to roads could be stronger, LAC's highest performers in that category tend to be smaller, island nations and Chile's 76 percent is consistent with the best performers in South America (Uruguay being something of an outlier). Additional indicators of infrastructure access in Figure 27 paint a better picture. With 100 percent of both urban and rural populations having access to electricity and 99 percent of the total population having access to clean water and improved sanitation, Chile is one of the strongest performers in the region.

Figure 24. Chile: WEF Infrastructure Rank, 2017¹⁷⁷

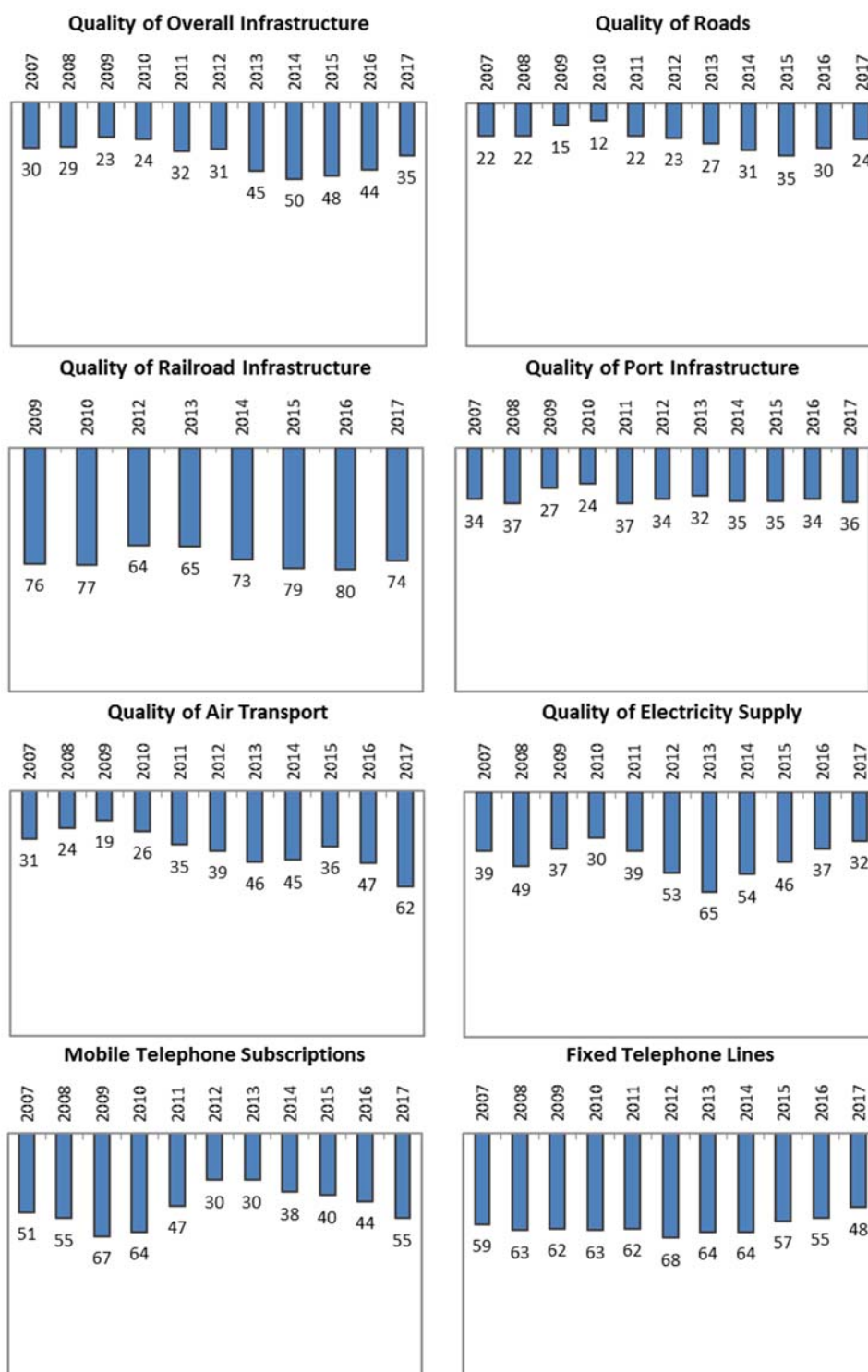


1 = Best, 137 = Worst. *LAC-6 Countries.

¹⁷⁶ The World Bank, World Development Indicators.

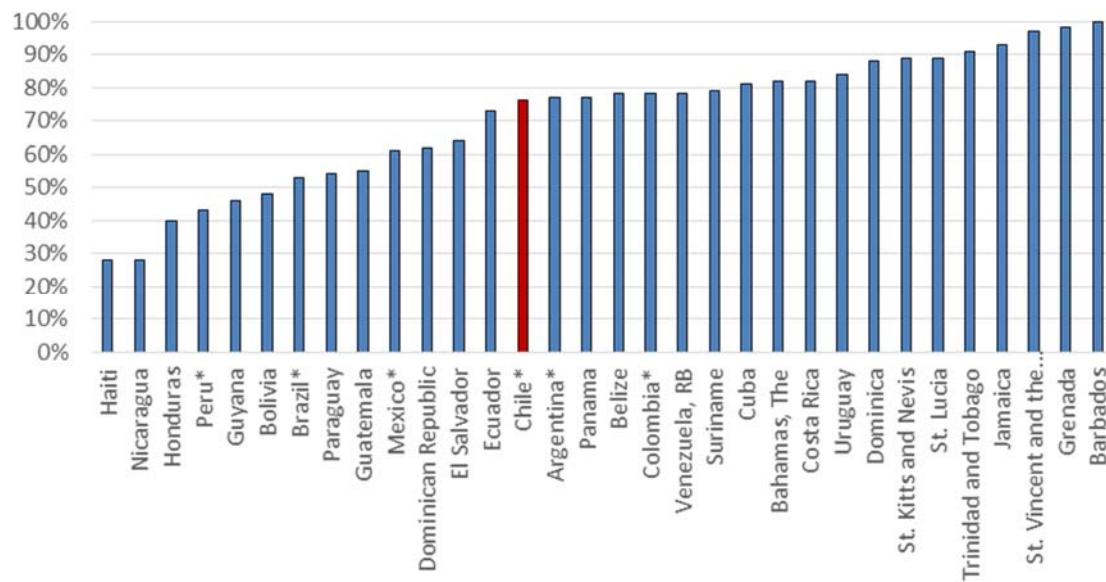
¹⁷⁷ Adapted from WEF GCI Dataset 2006–2017.

Figure 25. Chile: WEF Infrastructure Quality Indicators, 2007–2017¹⁷⁸



¹⁷⁸ Adapted from WEF GCI Dataset 2006–2017.

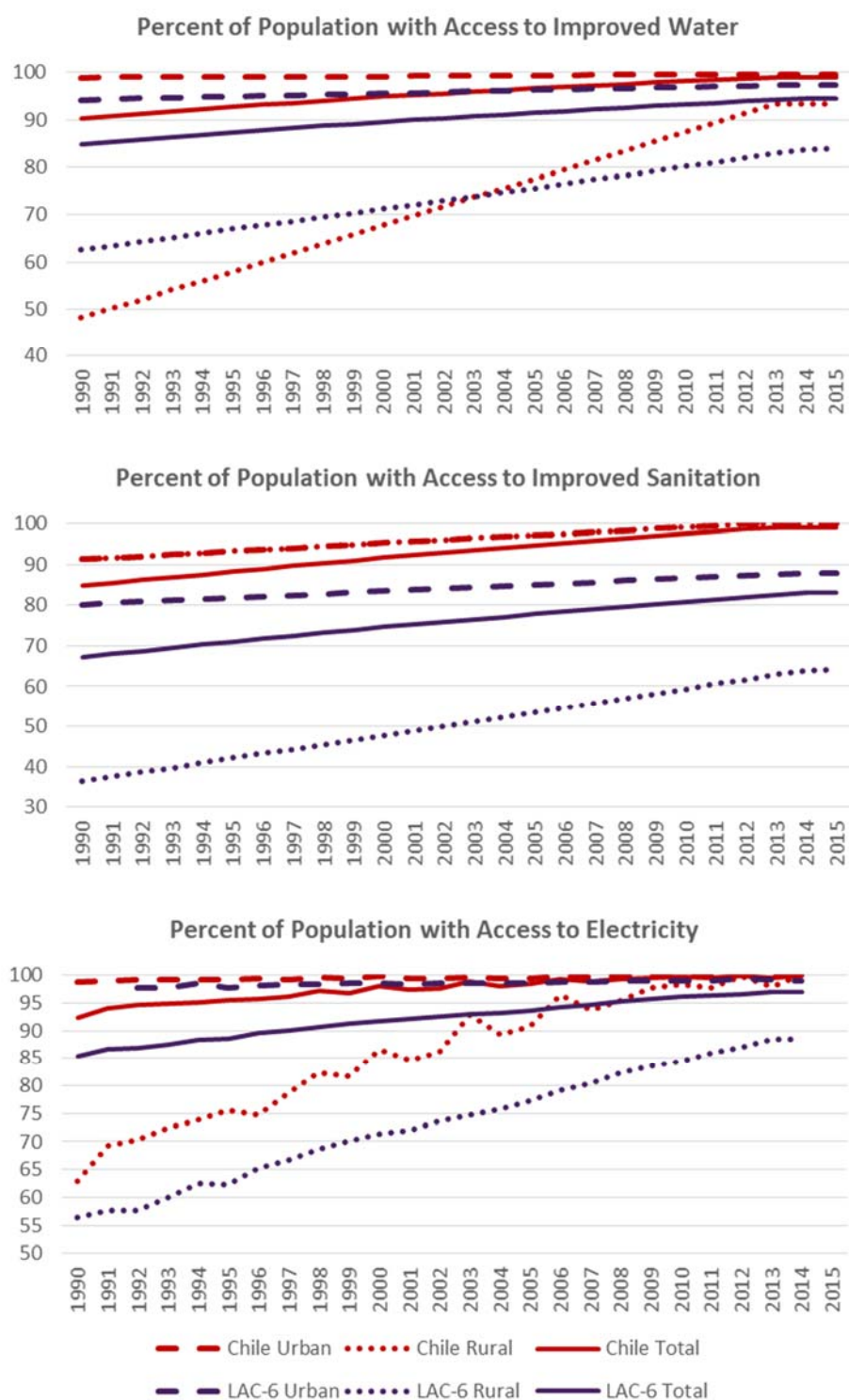
Figure 26. Chile: Rural Access Index, 1999–2004 Data¹⁷⁹



Percentage of rural population living within 2 kilometers of an all-season road. *LAC-6 Countries. Chile's data is from 2003.

¹⁷⁹ Adapted from World Bank, Rural Access Index.

Figure 27. Chile: Infrastructure Access Indicators, 1990–2015¹⁸⁰

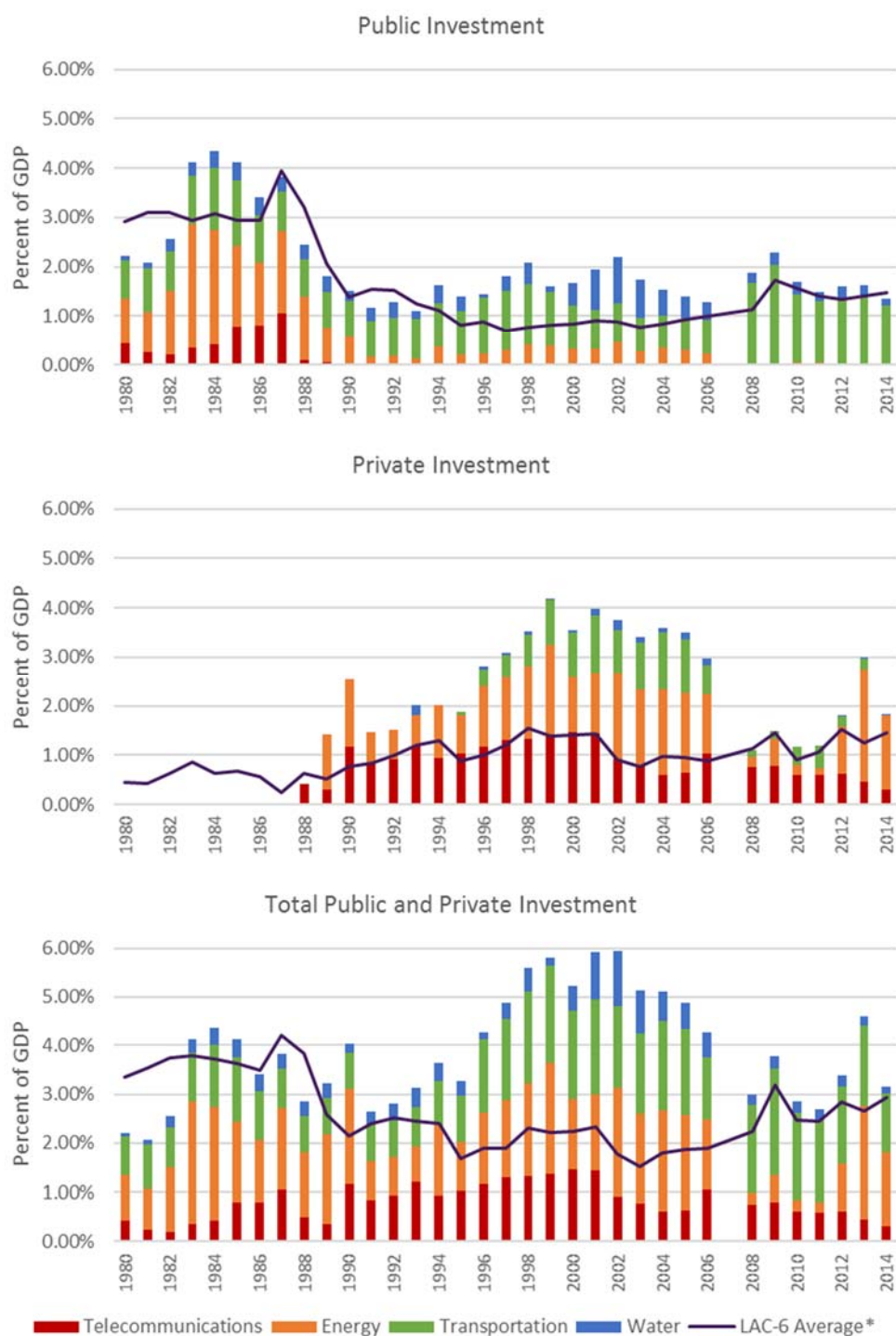


¹⁸⁰ Adapted from World Bank, World Development Indicators.

b. Infrastructure Investment Levels

In an examination of Chile's infrastructure investment trends it is easy to see how higher than average levels of both public and private investment have correlated to Chile's superior indicators of infrastructure quality, quantity, and access. When compared to the weighted LAC-6 averages Figure 28 shows that, as the region experienced a protracted decrease in investment following the debt crisis, Chile's public investments (although initially dropping) gradually increased beginning in the early 1990s. Even more significant, as the region struggled to fill the public funding gap with private investment, Chile was able to secure a great deal of private participation in infrastructure, resulting in total investments that moved opposite regional trends through the end of the 2000s and have remained above average ever since. Looking at the cross-sector comparison in Figure 29, we can see higher than average investment throughout, with private investment being particularly robust in telecommunications, energy, and transportation. Again, correlating to areas in which Chile maintains some of its highest infrastructure rankings.

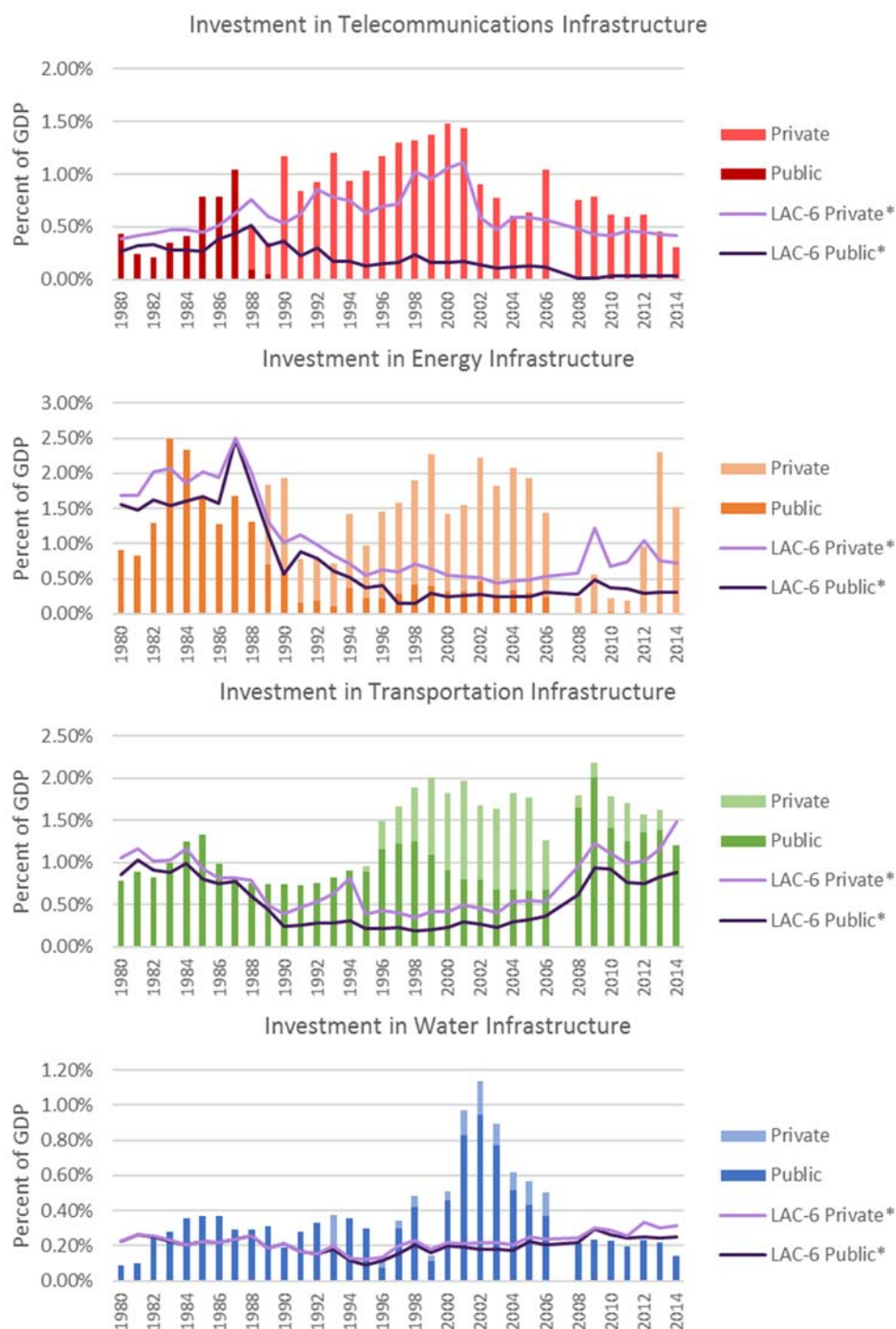
Figure 28. Chile: Public and Private Investment in Infrastructure, 1980–2014¹⁸¹



*GDP-weighted average. 2007 data not available.

¹⁸¹ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

Figure 29. Chile: Infrastructure Investment by Sector, 1980–2014¹⁸²



*GDP-weighted average. 2007 data not available.

¹⁸² Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

c. Institutional Effects

How have Chile's institutions shaped its level of infrastructure investment and development in contrast to the rest of the region? Chile's unique sequence of elections (occurring nationally prior to locally), its top-down approach to fiscal decentralization, and its a strong centrist tradition reinforced by the authoritarian Pinochet regime appear to have combined to limit clientelistic tendencies of elected officials and forced them to build their management capacity. As Chile continued to transition to democracy despite formal institutions designed to limit the power of the legislature and the number of political parties, Chile's political elites devised informal institutions to eliminate the threat of deadlock and ensure their ability to govern in order to prevent the return of authoritarianism. The subsequent coalition loyalty and a propensity to cooperate rather than compete has ensured higher and more consistent levels of effective and efficient government investment while spurring additional private investment, resulting in some of the highest levels of infrastructure development in the region.

Eaton identifies that, similar to Brazil, following the 1973 military coup and up until the 1992 constitutional reform, all subnational government officials were appointed by the central government.¹⁸³ Moreover, Bland indicates that the Pinochet regime, in requiring local governments to “develop an annual budget, zoning ordinance, and municipal development plans...Municipalities were thus obligated to establish various departments and hire professional technicians and administrators to head them.”¹⁸⁴ This, in turn, had the effect of pushing local governments to operate more along the lines of private businesses—ranking employees according to professional status and paying them better than before—which then attracted young professionals to work for the municipalities. The ultimate result, Bland goes on to say, was that “Pinochet's new subnational system was perhaps more technocratic, more development oriented, and maybe even more market oriented and efficient than the system it replaced.”¹⁸⁵

¹⁸³ Eaton, 141.

¹⁸⁴ Gary Bland, “Enclaves and Elections: The Decision to Decentralize in Chile,” in *Decentralization and Democracy in Latin America*, ed. Alfred P. Montero and David J. Samuels (Notre Dame, IN: University of Notre Dame, 2004), 99.

¹⁸⁵ *Ibid.*, 102.

Additionally, while municipalities did receive ad hoc transfers of fiscal resources to administer the programs they were now responsible for, transfers did not always cover costs and local officials remained more agents of the central government than independent entities with the power to allocate resources.¹⁸⁶ Furthermore, Chile's 1980 constitution created an extremely strong executive with an extraordinary degree of control over legislation related to state financing, denying legislators with the same tools traditionally used in other countries to develop clientelistic networks within their constituencies.¹⁸⁷ Through this period of highly centralized authoritarian rule, the Pinochet regime created a system of local officials with low levels of autonomy, but the consequence was that they achieved much higher levels of management capacity than in Brazil or Mexico.

Combined with Chile's unique process of democratization (initiated from the top-down as in the other cases) that saw national elections precede those at the municipal level, Eaton notes that although the 1992 constitution brought limited political and fiscal decentralization through new a regional government structure, it did not result in bottom-up demands for fiscal autonomy.¹⁸⁸ Bland argues, "the guiding impulse to decentralize was national politics."¹⁸⁹ In other words, President Aylwin used decentralization as a means to support the new, democratic regime and prevent a possible return to authoritarianism during the initial stages of the transition. "Municipalities were guaranteed legal rights and administrative autonomy under the constitution," Bland asserts and, as political decentralization has advanced in Chile since 1992 and municipal governments have gained financial responsibilities, "the Chilean centrist tradition remains among the strongest in Latin America. Although local governments crossed an important threshold in the 1990s, their level of autonomy vis-à-vis the center and regions

¹⁸⁶ Eaton, 144–145.

¹⁸⁷ Bland, 112–113.

¹⁸⁸ Eaton, 145.

¹⁸⁹ Bland, 110.

continues to be limited by ministerial decision making or interference in purely local concerns.”¹⁹⁰

As Chile’s level of decentralization evolved partly in response to the threats still posed by Pinochet and the military, so did its informal political institutions. Those institutions in turn, have shaped the electoral politics and the incentives of politicians. Siavelis notes that when Pinochet’s dictatorship ceded control and Chile returned to democracy in 1990, the military had engineered a strong executive and a weak legislature that confronted significant electoral engineering in an effort to reduce the number of political parties.¹⁹¹ Facing what some analysts consider a “recipe for deadlock,” Siavelis argues that Chile’s political elites devised informal systems to prevent the lingering threat that the military posed by ensuring that they could effectively govern and that democracy would work.¹⁹² The result was that Chile’s governing, center-left *Concertación* coalition built several informal political institutions that stabilized intra-coalition competition and contributed to the success of Chile’s democracy. Additionally, Carey and Siavelis indicate that, similar to Brazil, Chile’s legislative elections include open lists where voters indicate a preference for a candidate within their preferred party list, with votes for each party first pooled together in order to distribute seats to the list, and then to candidates within each party list.¹⁹³ However, unlike Brazil, each district in Chile elects two representatives and, with a high vote threshold required for one party to secure both seats, Chile’s two major political coalitions face a condition where they typically expect one of their two candidates in each district to be defeated; in turn, leading to a strategy of either doubling up on strong candidates in an effort to secure both seats or pairing a strong candidate with a weaker one who will not garner more votes. While this arrangement has the possibility of creating tension or competition between individual

¹⁹⁰ Ibid., 109, 115.

¹⁹¹ Peter Siavelis, “Accommodating Informal Institutions and Chilean Democracy,” in *Informal Institutions and Democracy: Lessons from Latin America*, ed. Gretchen Helmke and Steven Levitsky (Baltimore, MD: Johns Hopkins University Press, 2006), 33–35.

¹⁹² Ibid., 35–36.

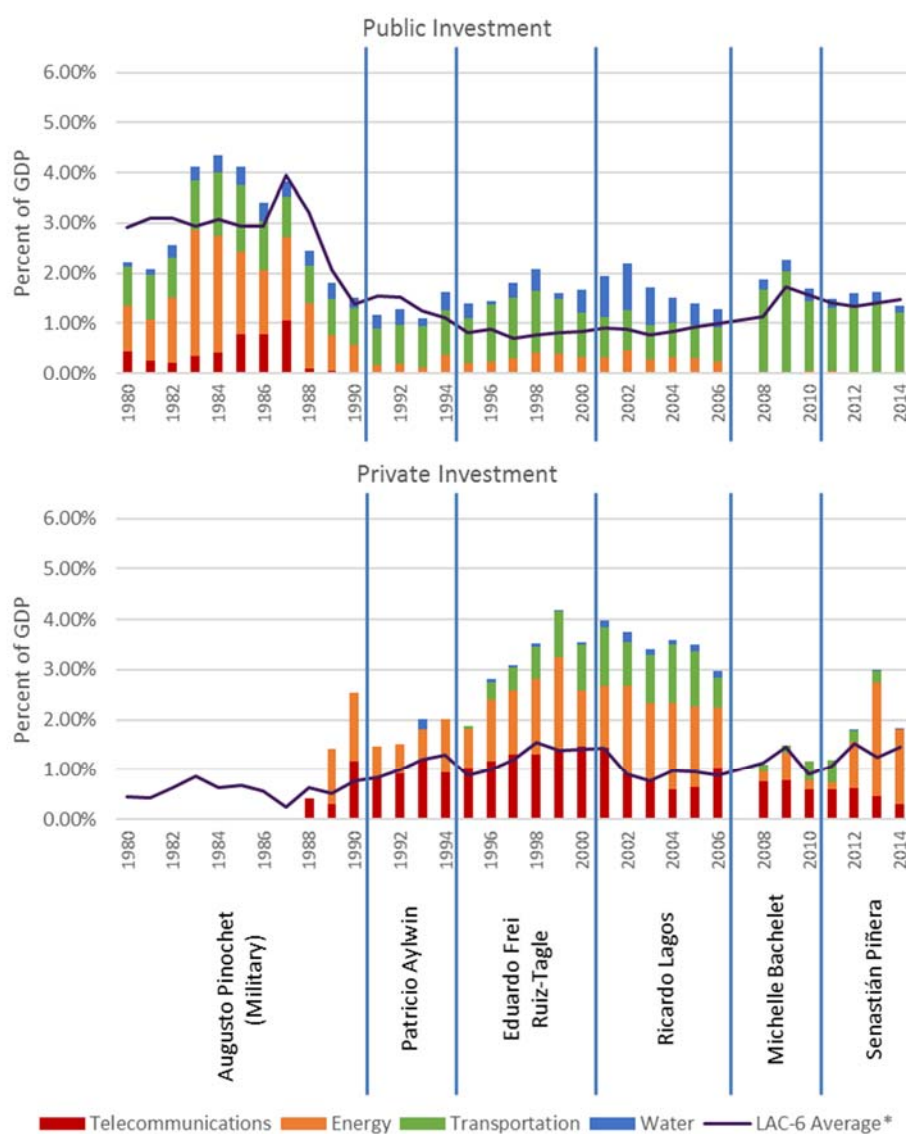
¹⁹³ John M. Carey and Peter Siavelis, “Election Insurance and Coalition Survival: Formal and Informal Institutions in Chile,” *Informal Institutions and Democracy: Lessons from Latin America*, ed. Gretchen Helmke and Steven Levitsky (Baltimore, MD: Johns Hopkins University Press, 2006), 163–164.

candidates' personal career goals and the collective goals of their coalition, Carey and Siavelis reveal that to mitigate these effects coalitions offer their stronger candidates insurance in the form of a guaranteed political appointment should they lose the election.¹⁹⁴ This insurance strengthens the link between individual politicians and the coalition, as well as enhances cooperation among politicians and parties within the coalition.

In these ways, Chile has followed a divergent path than Brazil or Mexico. While its political decentralization in the democratic transition did proceed from the top down like the other two cases, Chile's unique sequence of democratic elections—occurring at the national level prior to the subnational level—combined with a highly centralized state structure to first build the managerial capacity and technocratic tendencies of local officials, and then limit those officials' demands for additional autonomy. Furthermore, as Chile's democratic transition progressed in spite of the country's formal institutions (engineered by the authoritarian regime to limit political parties and increase government deadlock), political elites were able to use informal institutions and political coalitions to promote cooperation in order to prevent a possible return to military rule. Taken together, these factors have ensured that Chile has maintained higher and less volatile levels of public and private investment in infrastructure (reflected in Figure 30), with a greater emphasis on effectiveness and efficiency, resulting in some of the highest levels of infrastructure, quality, quantity, and access in the region.

¹⁹⁴ Ibid., 166.

Figure 30. Chile: Public and Private Infrastructure Investment by Presidential Administration¹⁹⁵



*GDP-weighted average. 2007 data not available.

¹⁹⁵ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralataam Database.

C. ANALYSIS

Taken together, the case of Brazil, combined with a preliminary examination of Mexico and Chile, have supported the significant role that each country's formal and informal institutions have had on their varying levels of infrastructure investment and development. These three cases have further emphasized how—through very different conditions and in different ways—institutions have remained at the center of the forces that shape the incentives and constraints political leaders face regarding policy choices and outcomes. However, in comparing the way in which diverse institutional factors across these cases have led to the varying outcomes in terms of infrastructure and development, I was struck by one important realization. Namely, that while levels of fiscal and political decentralization hold some explanatory power, what may be just as important are the driving forces behind decentralization and the manner in which the process took place. In her examination of fiscal decentralization in relation to electoral competition in Mexico, Beer notes that there is a weakness in approaching institutions statically.

... without acknowledging the fact that institutional characteristics such as the centralization of the party system and electoral laws tend to reflect the deeper distributions of power within the political system. Institutional factors such as the type of proportional representation (PR) system, candidate selection processes, and the timing of elections should be thought of as *intervening variables* because they are the outcome of struggles between contending forces and thus both reflect and enforce an enduring distribution of power.¹⁹⁶

With that insight and my observations from Brazil, Mexico, and Chile in mind, I constructed Table 2 in order to take another look the institutional factors affecting infrastructure investment in each case—not just their shape, but also the process by which they occurred.

¹⁹⁶ Beer, 188.

Table 2. Analysis of Factors Affecting Infrastructure Investment in Latin America

Country	Distribution of Power	Sequence of Elections	Decentralization		Party Loyalty	Infrastructure	
			(Political)	(Fiscal)		(Investment)	(Development)
Brazil	Federal	Subnational ↓ National	Top Down	Bottom Up	Low	Medium	Low
Mexico	Federal	Subnational ↓ National	Top Down	Bottom Up	High	Low	Medium
Chile	Unitary	National ↓ Subnational	Top Down	Top Down	High	High	High

Consistent with my previous observations, it appears that between Brazil and Mexico, the one alternating variable is the level of party loyalty. In both countries, decentralization ran concurrent with democratization with elections first occurring at the subnational level in a top-down direction. As a result, both countries experienced bottom-up demands for fiscal decentralization. However, where Brazil's electoral system promoted individualism at the expense of political parties, Mexico's seven decades of single-party rule under the PRI resulted in a de facto centralized state. This, in turn may have led to less infrastructure investment in Mexico but it placed a greater emphasis on effectiveness and efficiency resulting in a higher degree of infrastructure development, albeit with limited access. Chile, on the other hand, shows greater variation from the other two cases. With a constitutionally unitary government, Chile's long tradition of centralized political power may not only explain why its democratic transition began with national elections prior to municipal ones, but also why there weren't more calls from local officials for greater fiscal autonomy as politics decentralized. Of course, the threat of a return to authoritarian rule that persisted throughout the democratic transition certainly influenced Chile's political elite to devise informal ways of ensuring the proper functioning of the government, helping to ensure more programmatic investment decisions. Nevertheless, in the case of Chile's infrastructure, the shared effect was high levels public and private investment resulting in greater quality, quantity, and access.

D. RECOMMENDATIONS

With not only the shape of institutions but also the process by which they evolve playing such a significant role in infrastructure investment in Latin America, what can be done if the goal is to not only increase and maintain public and private infrastructure investment, but to also effectively and efficiently use limited resources to develop infrastructure in terms of increase quality, quantity, and access?

I have shown that formal and informal political institutions have played a fundamental role in shaping fiscal policy and infrastructure investment in Latin America through the way they determine an individual leader's incentives and constraints. However, institutional fixes are not always the proper (let alone the most feasible) way to resolve the issue. It is within that context that we can revisit the previously addressed discussion of Hausmann and what he identifies as the four main challenges of public institutions that governments face—aggregation of individual preferences, coordinating the use of common but limited resources, individual agency, and commitment or a long-term outlook—as a first step towards addressing the some of the options available.¹⁹⁷

While Hausmann acknowledges that political and electoral systems have an impact on a country's fiscal performance, he rightfully asserts, “it is unreasonable to expect them to be adopted on the basis of their fiscal impact. There are other considerations related to social cohesion that override narrow macroeconomic objectives.”¹⁹⁸ He suggests three broad strategies that governments can take to address these problems: designing budget rules and institutions based on their desired outcomes, taking into account the impact that electoral systems and political institutions have on fiscal performance; delegating spending and spending and deficit rules to the executive as opposed to the legislature; and increasing transparency and accountability through independent agencies that audit outcomes and monitor fiscal rules.¹⁹⁹ Additionally, Hausmann provides us with Table 3 that presents how each strategy can address each of

¹⁹⁷ Hausmann, 13.

¹⁹⁸ Ibid., 22.

¹⁹⁹ Ibid., 21–25.

the four main institutional challenges. Though not necessarily addressing the specific institutional effects related to infrastructure investment and development in Brazil, Mexico, or Chile, Hausmann's strategies offer a preliminary approach for governments attempting to address the complex challenges and interactions of political and fiscal institutions.

Table 3. No Silver Bullet: Strategies vs. Problem²⁰⁰

	Coordination	Commitment	Flexibility	Agency
Rules-based strategies	Rules that address coordination problems may be inefficient or inadequate to address commitment problems.	Rules that address commitment problems may be inefficient or inadequate to address coordination problems.	Are unlikely to respond effectively in volatile environments unless rules are complicated. This may allow their abuse. Moreover, the rule itself may be inefficient.	Rule must be interpreted and agents can abuse the interpretation for their own interest, making the rule less credible.
Delegation to agenda setter	Agenda setter may coordinate efficiently.	Agenda setter may suffer from time inconsistency problems.	Agenda setter may use his discretion to adapt to changing circumstances.	Agenda setter may aggravate agency problems (e.g., electoral budget cycle).
Disclosure/transparency	Coordination when the other's actions are unobservable may cause the collapse of cooperative equilibria.	Commitment to an unobservable behavior may not be credible.	Credible information may be critical to distinguishing shocks from abuse.	In so far as it makes the agent's actions more observable it should reduce agency.

E. FUTURE RESEARCH

Given the complexity of this project, it should come as no surprise that there exist several different avenues for possible future research on the political economy of infrastructure investment in Latin America. I have endeavored to combine a manner of depth through my study of Brazil as well as width through my preliminary analysis of Mexico and Chile. With that, the first point of departure for future research would be to

²⁰⁰ Source: Hausmann, 21.

re-scope this study in deeper or wider terms. A deeper study could take the form of either a subnational comparison of infrastructure investment across Brazil to see how individual states (existing within the same framework of federal institutions) have affected or been affected by institutional challenges in their own investment and development of infrastructure; or a cross-sector approach in order to determine to what extent institutions have had on investment and development across telecommunications, transportation, energy, or water and sanitation. On the other hand, a broader study could include additional comparisons with the rest of the LAC-6 countries (I have provided their individual infrastructure investment and development trends in Annex A), other subsets of Latin American countries grouped by income level or infrastructure performance, or by comparing Latin America with other developing regions or countries.

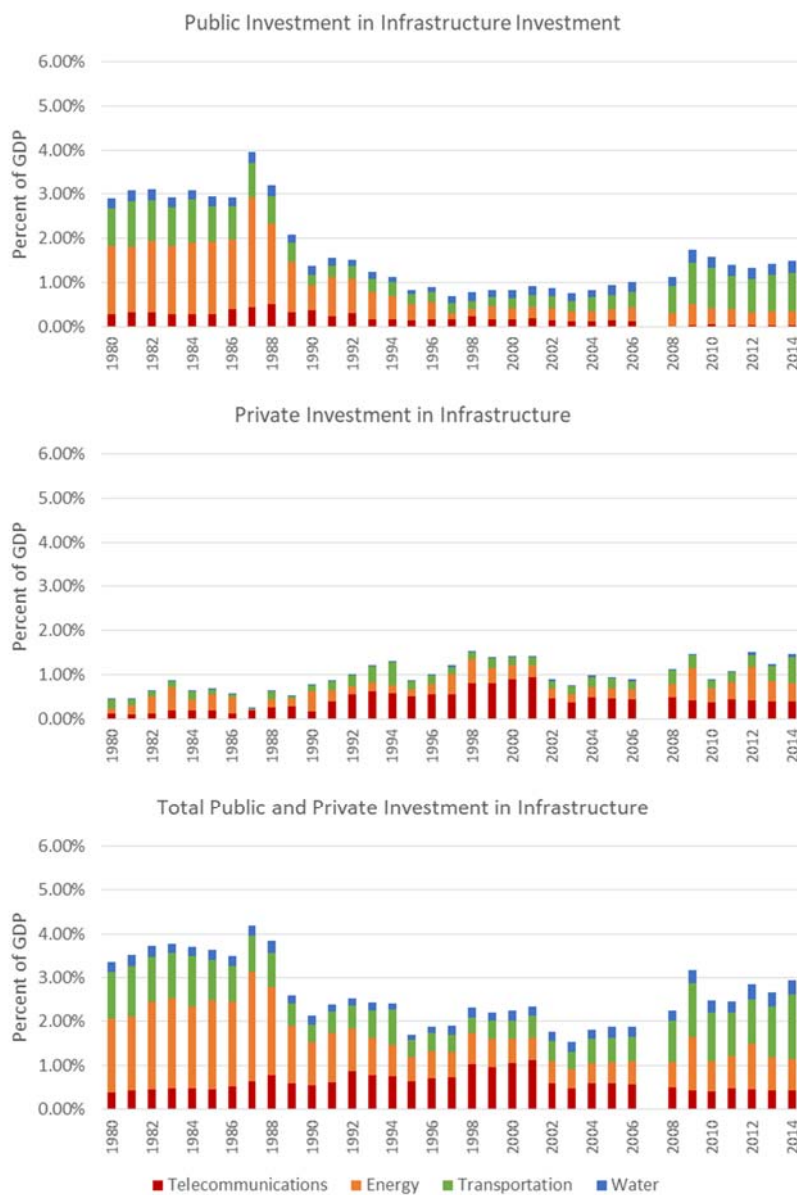
Alternatively, further research could expand on other political and fiscal institutions; their form, function, or how they interact with one another. Detailed understanding of how the deeper distribution of—and struggles for—political power in a country shapes institutional characteristics as *intervening variables* can be applied to many areas outside of infrastructure investment and form a key component in the study of political economy. Finally, as more and higher quality data begins to emerge on infrastructure investment and development across country and sector, empirical analysis on all of these factors could shed light on the relative impact that variable (including the distribution of power, the level of—and forces driving—political and fiscal decentralization, the type of electoral system, the timing of elections, the shape and strength of political parties or coalitions) has on infrastructure development, could provide a greater focus for addressing the challenges that countries face.

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APPENDIX A. ADDITIONAL FIGURES

A. LAC-6

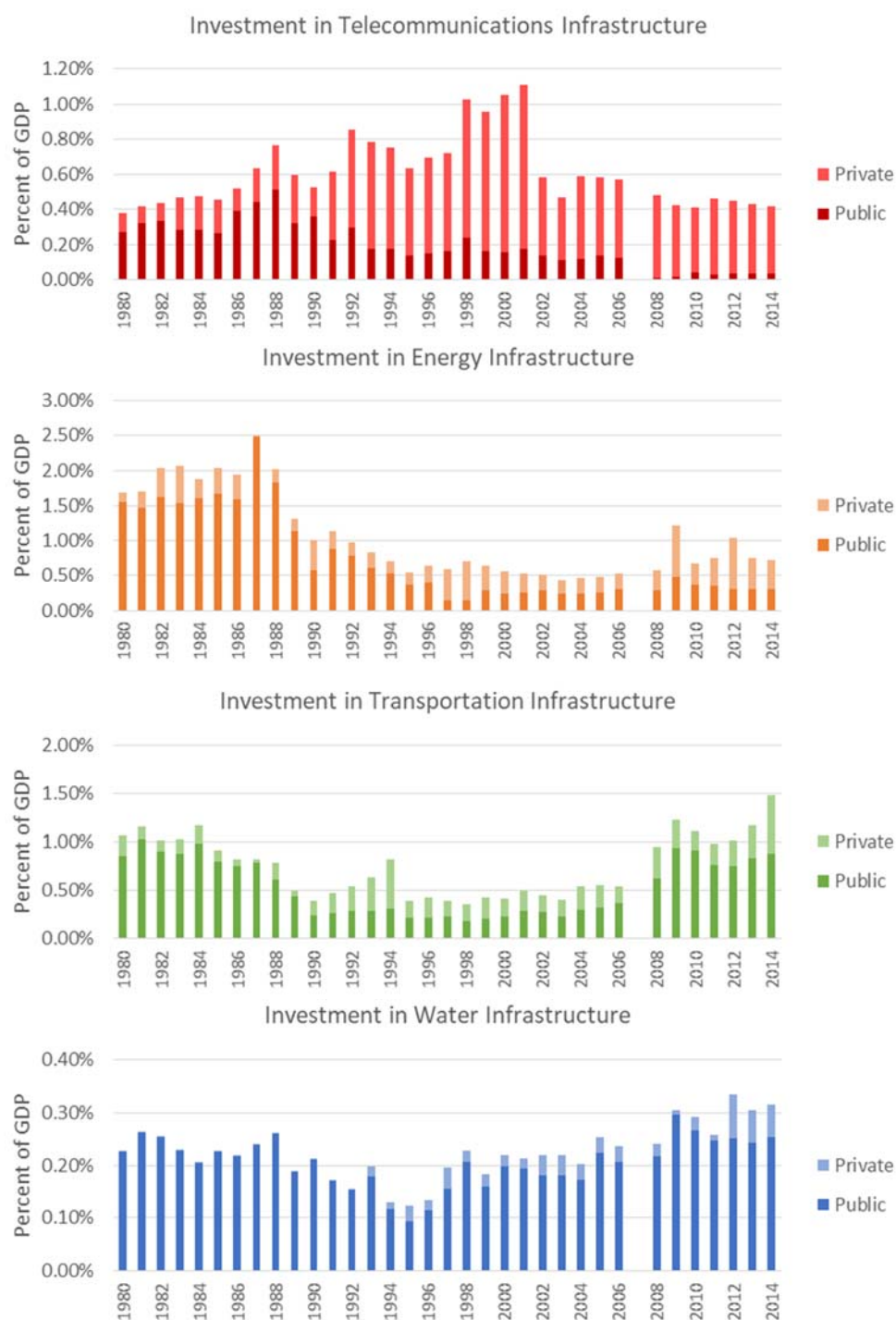
Figure 31. LAC-6: Average Public and Private Investment in Infrastructure, 1980–2014²⁰¹



GDP-weighted average. 2007 data not available.

²⁰¹ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralata Database.

Figure 32. LAC-6: Infrastructure Investment by Sector, 1980–2014²⁰²

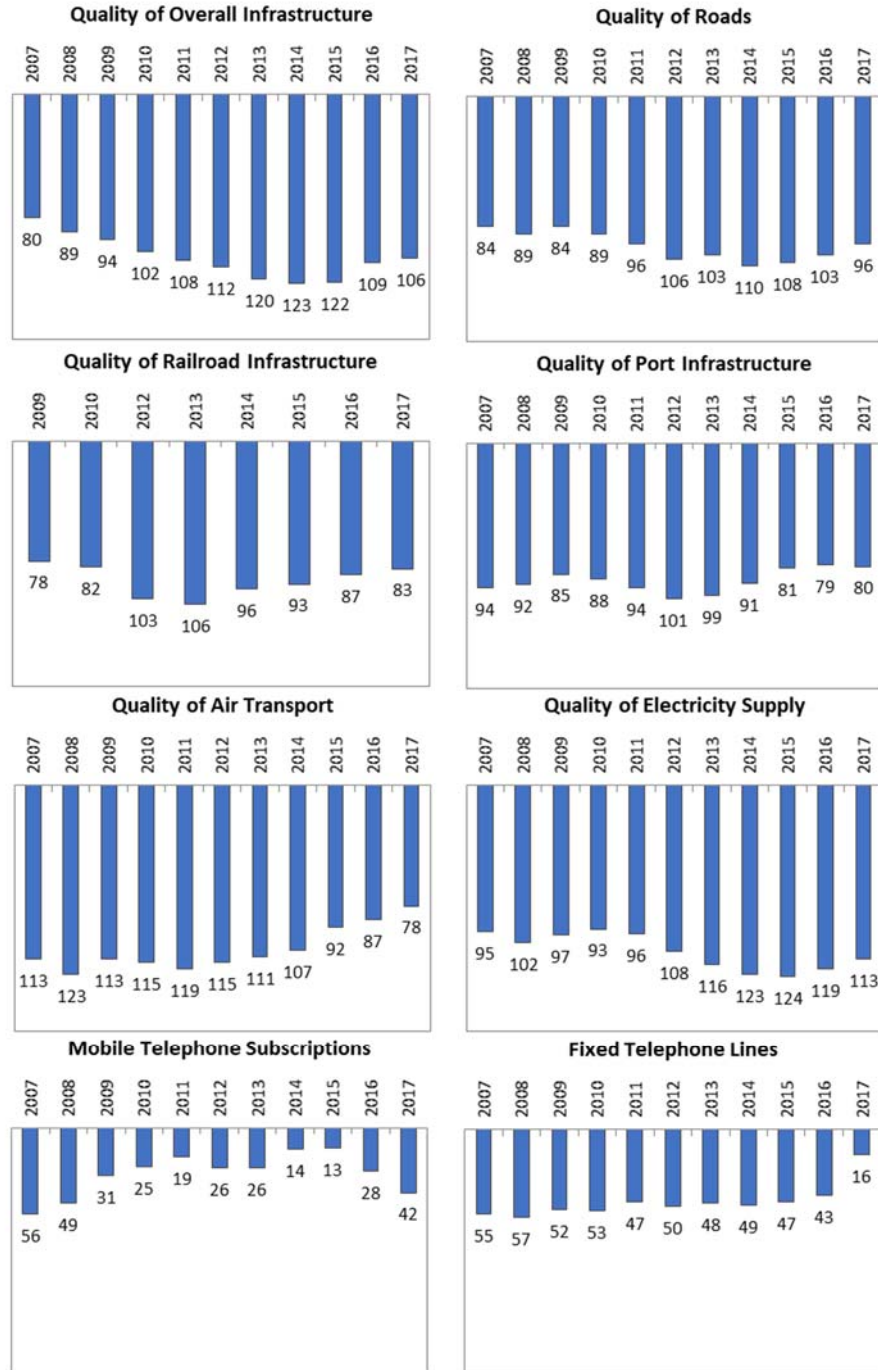


GDP-weighted average. 2007 data not available.

²⁰² Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralata Database.

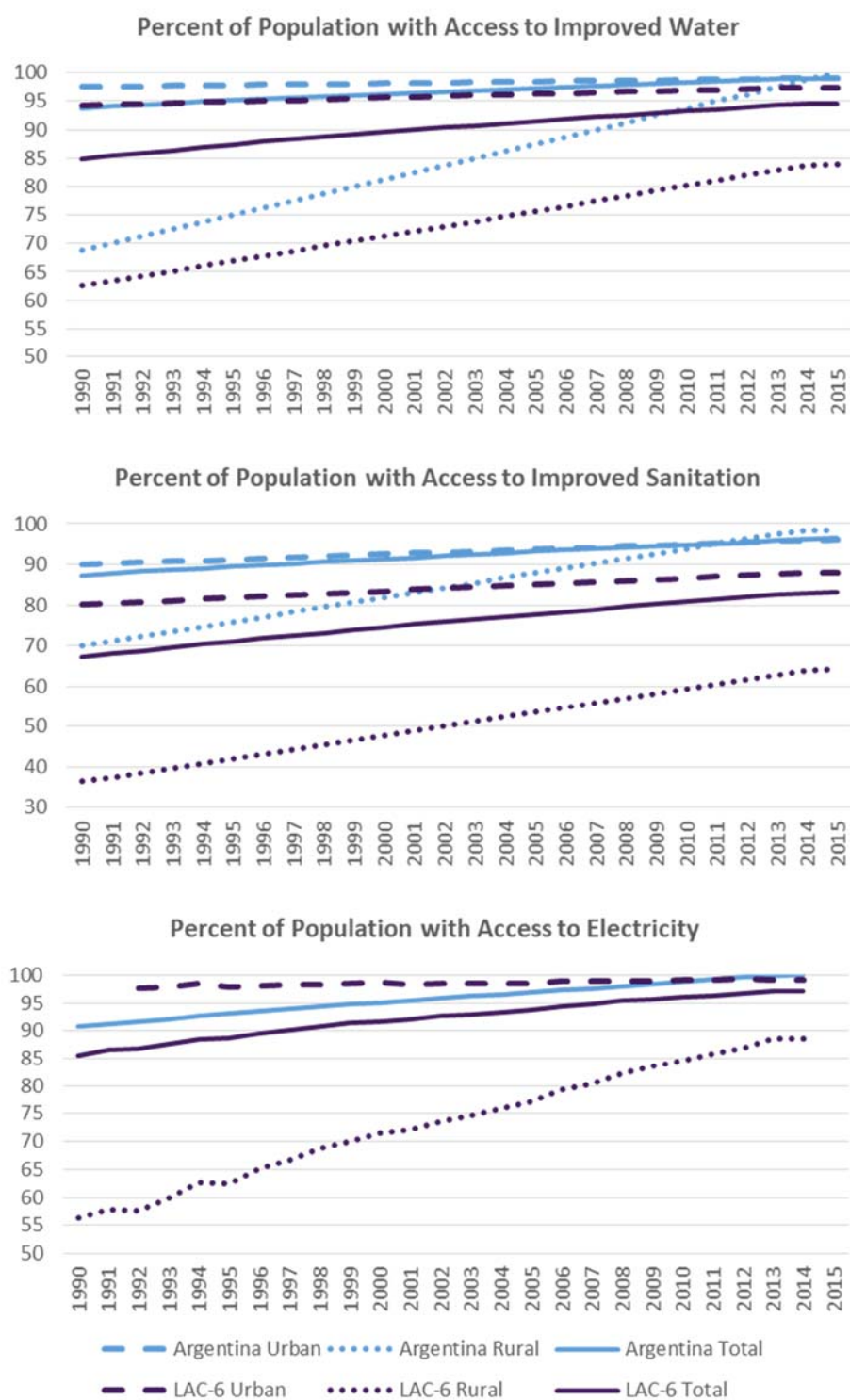
B. ARGENTINA

Figure 33. Argentina: WEF Infrastructure Quality Indicators, 2007–2017²⁰³



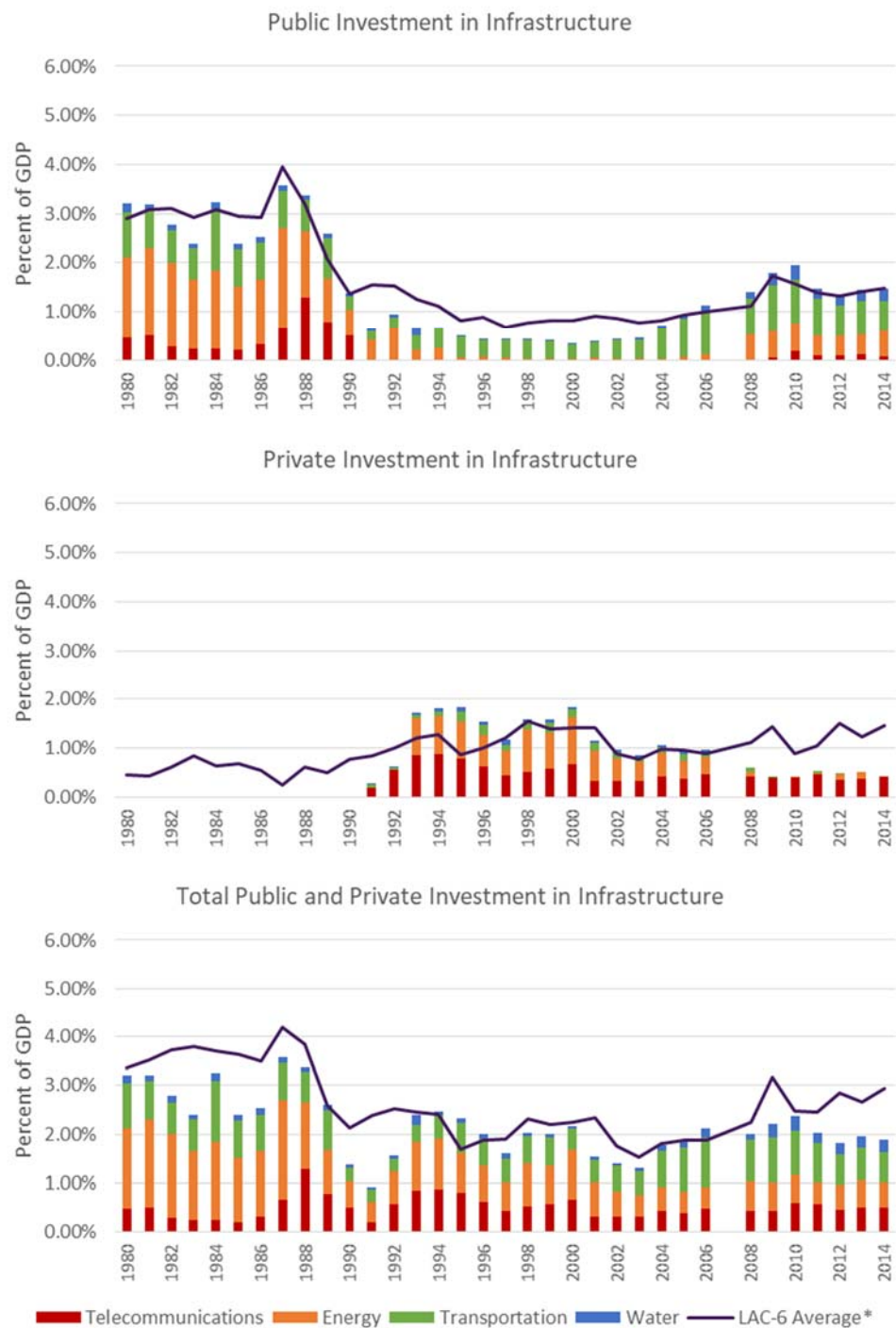
²⁰³ Adapted from WEF GCI Dataset 2006–2017.

Figure 34. Argentina: Infrastructure Access Indicators, 1990–2015²⁰⁴



²⁰⁴ Adapted from World Bank, World Development Indicators.

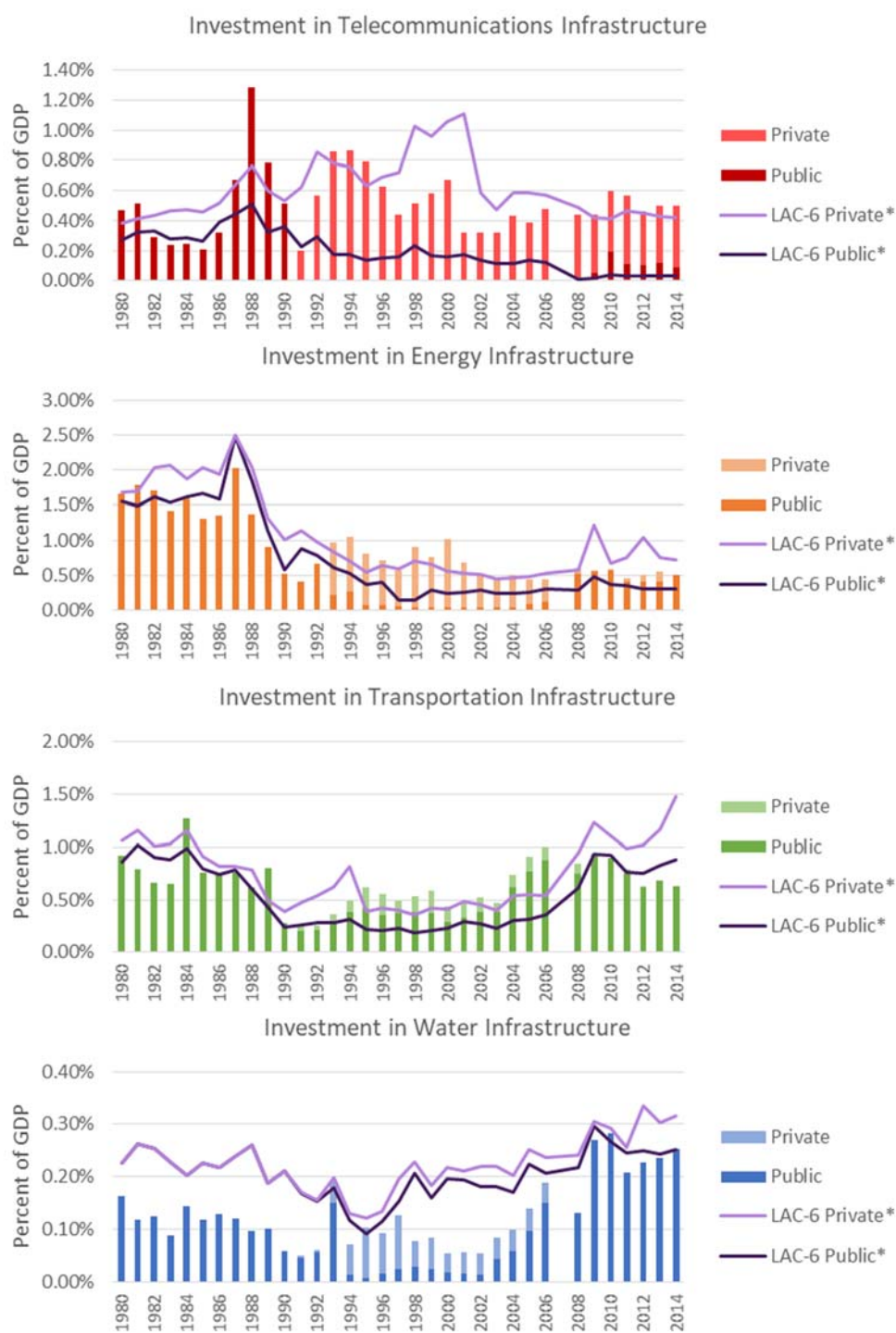
Figure 35. Argentina: Public and Private Investment in Infrastructure, 1980–2014²⁰⁵



*GDP-weighted average. 2007 data not available.

²⁰⁵ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralata Database.

Figure 36. Argentina: Infrastructure Investment by Sector, 1980–2014²⁰⁶

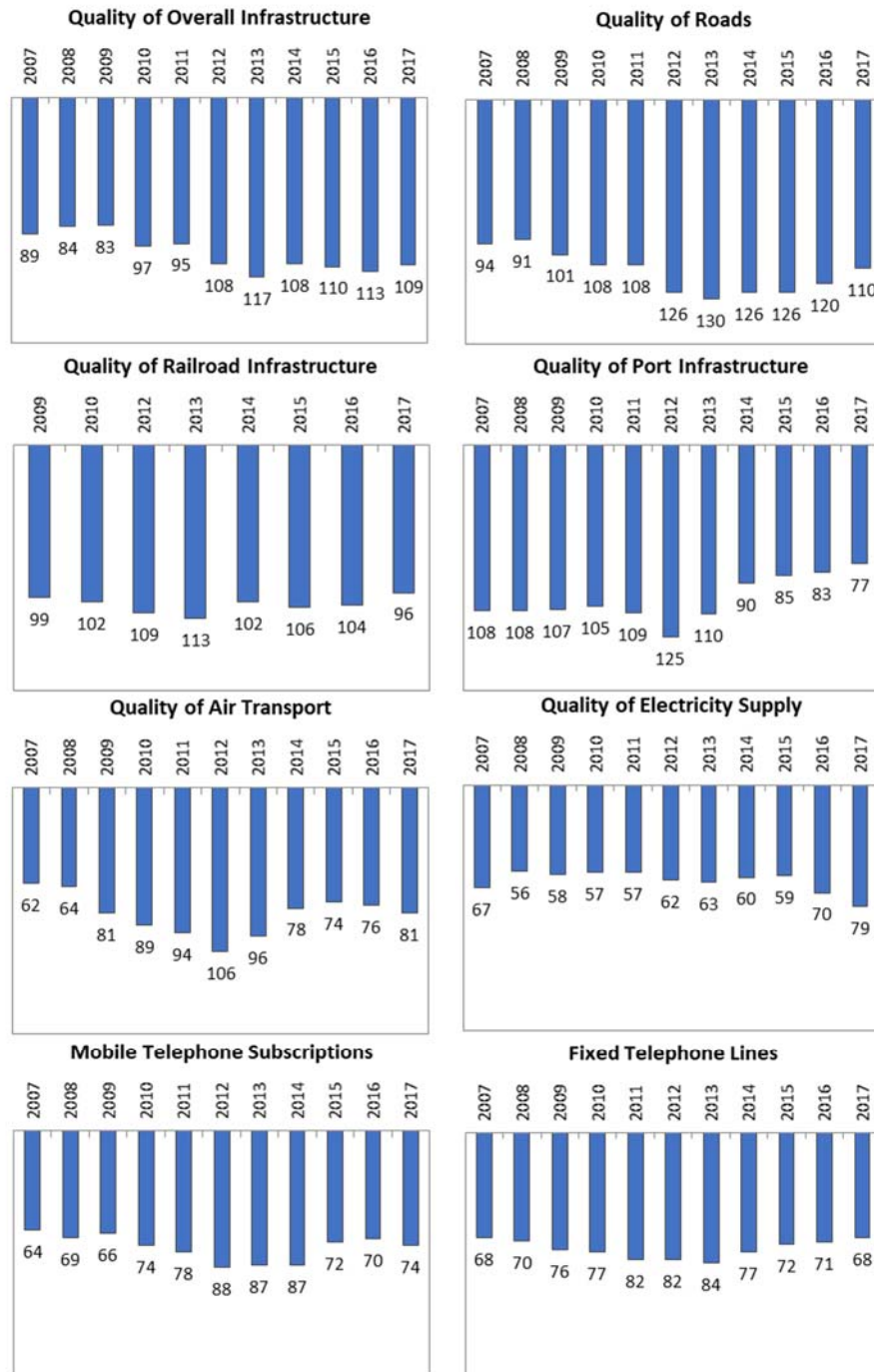


*GDP-weighted average. 2007 data not available.

²⁰⁶ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

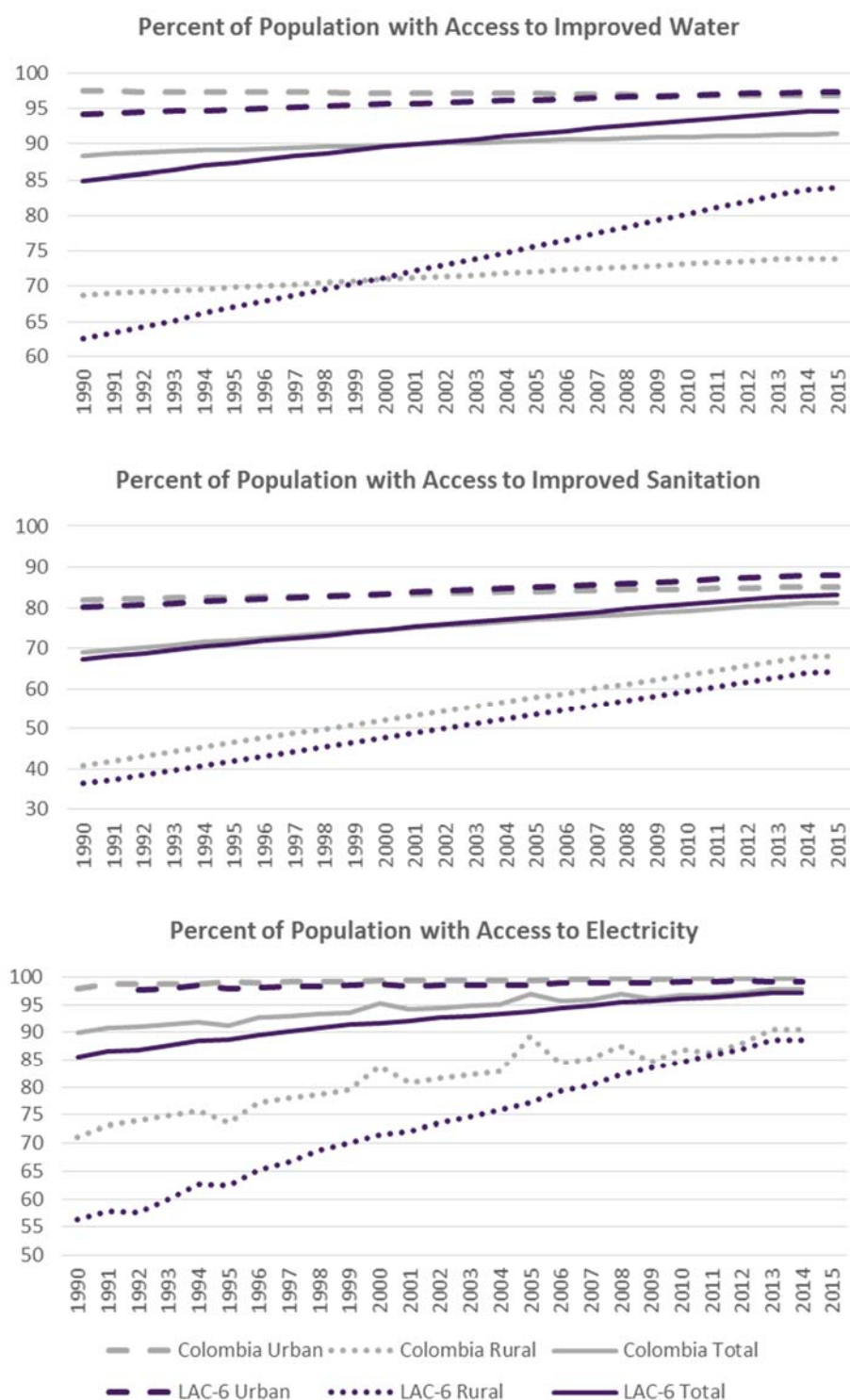
C. COLOMBIA

Figure 37. Colombia: WEF Infrastructure Quality Indicators, 2007–2017²⁰⁷



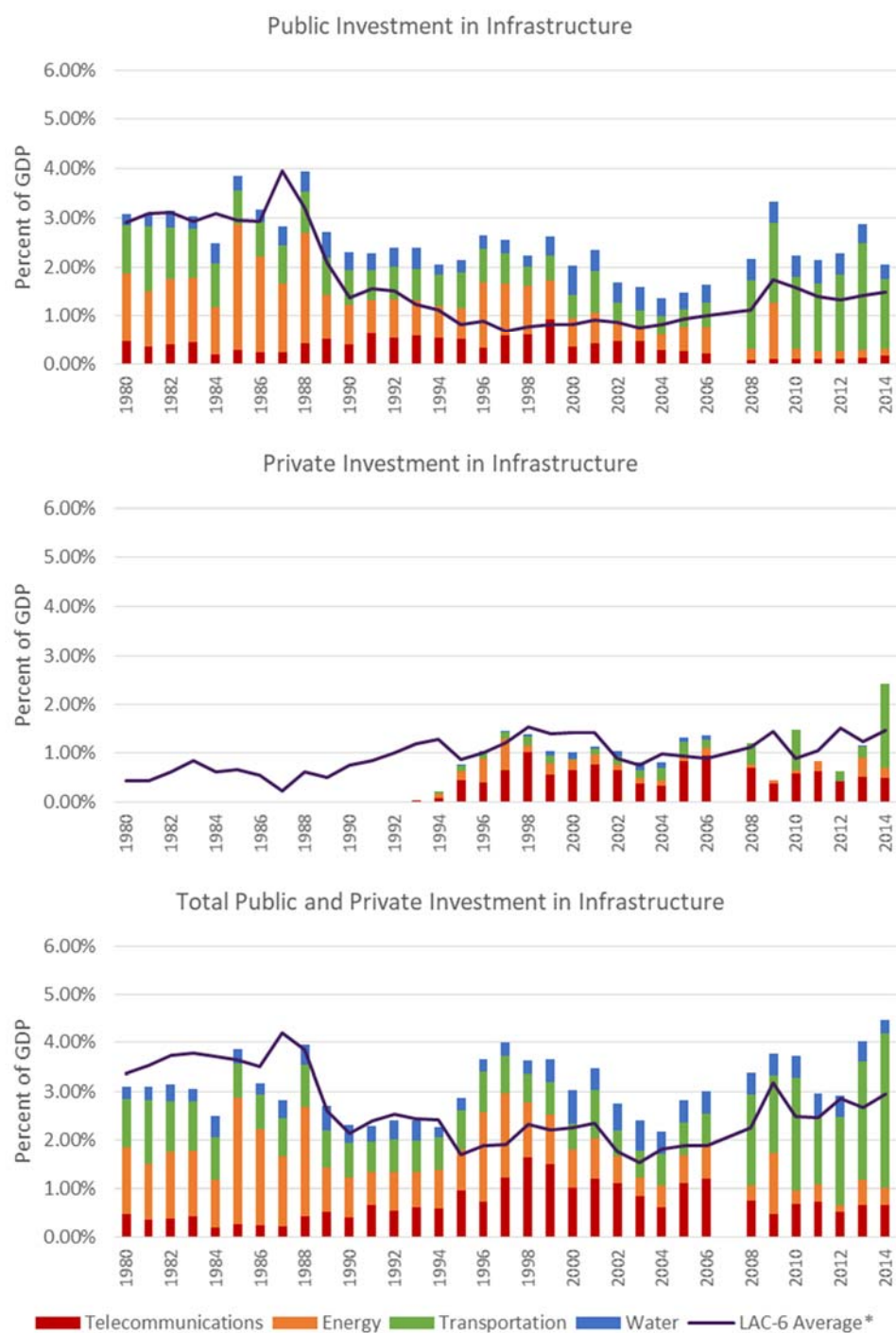
²⁰⁷ Adapted from WEF GCI Dataset 2006–2017.

Figure 38. Colombia: Infrastructure Access Indicators, 1990–2015²⁰⁸



²⁰⁸ Adapted from World Bank, World Development Indicators.

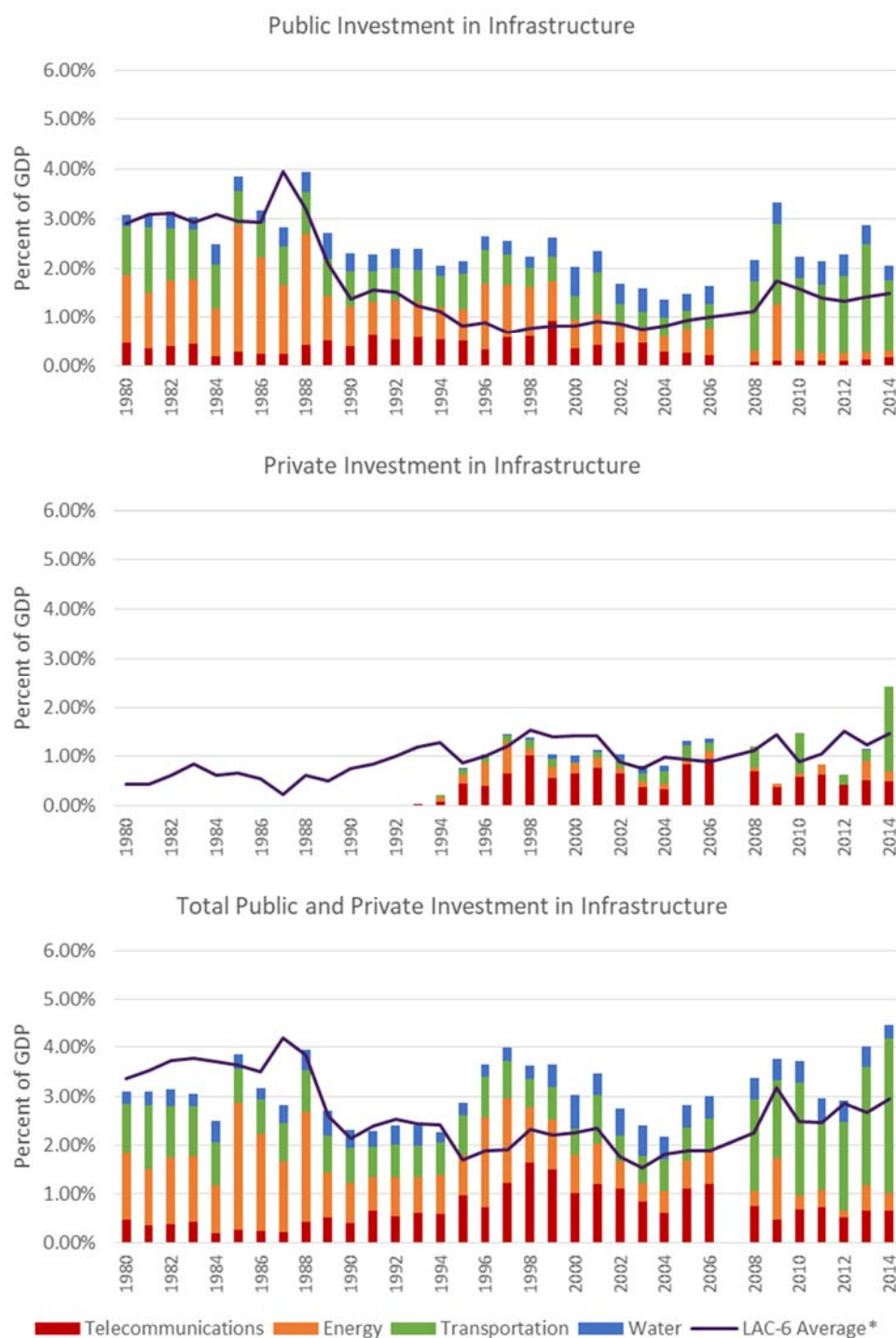
Figure 39. Colombia: Public and Private Investment in Infrastructure, 1980–2014²⁰⁹



*GDP-weighted average. 2007 data not available.

²⁰⁹ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

Figure 40. Colombia: Infrastructure Investment by Sector, 1980–2014²¹⁰

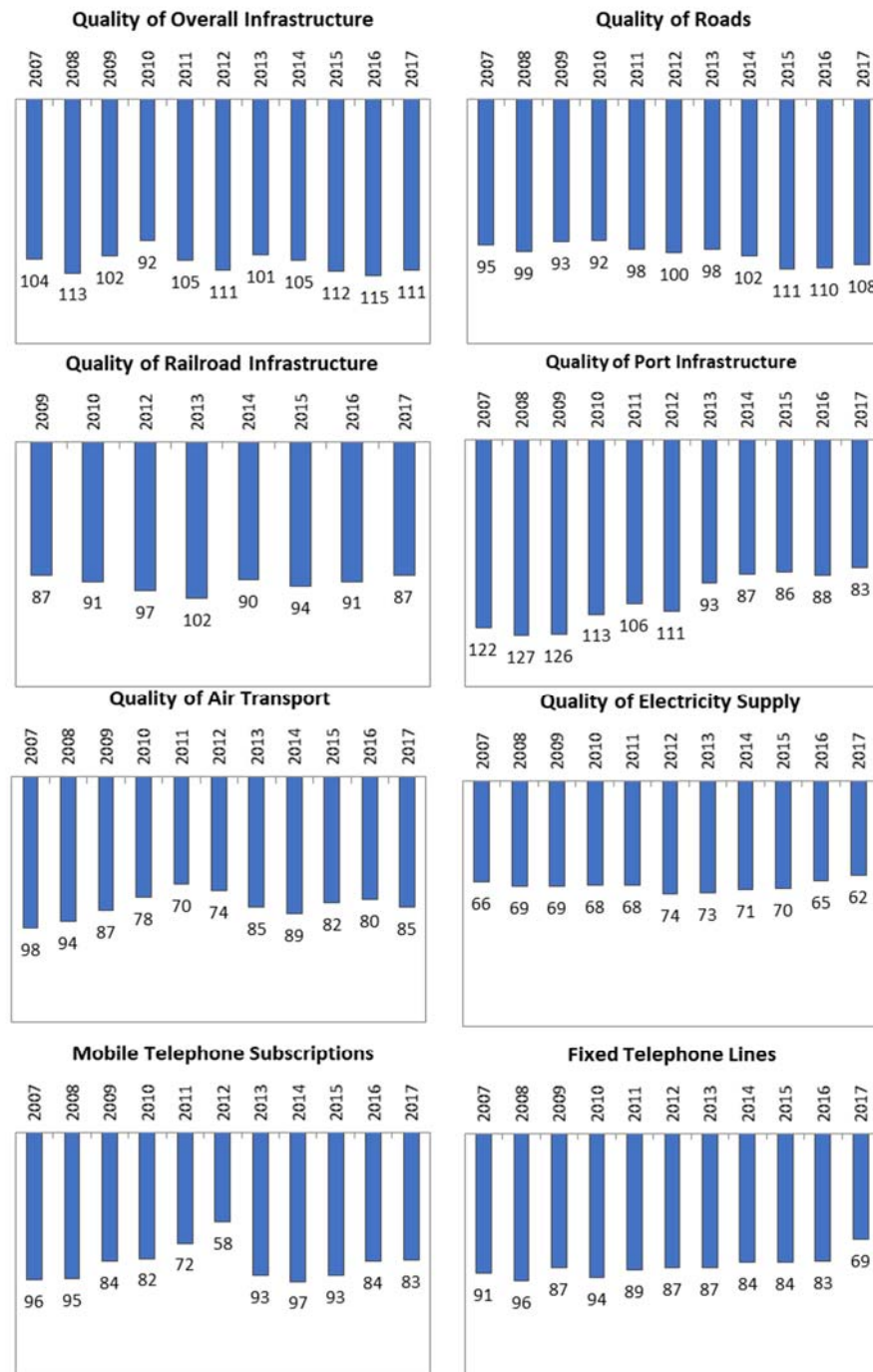


*GDP-weighted average. 2007 data not available.

²¹⁰ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

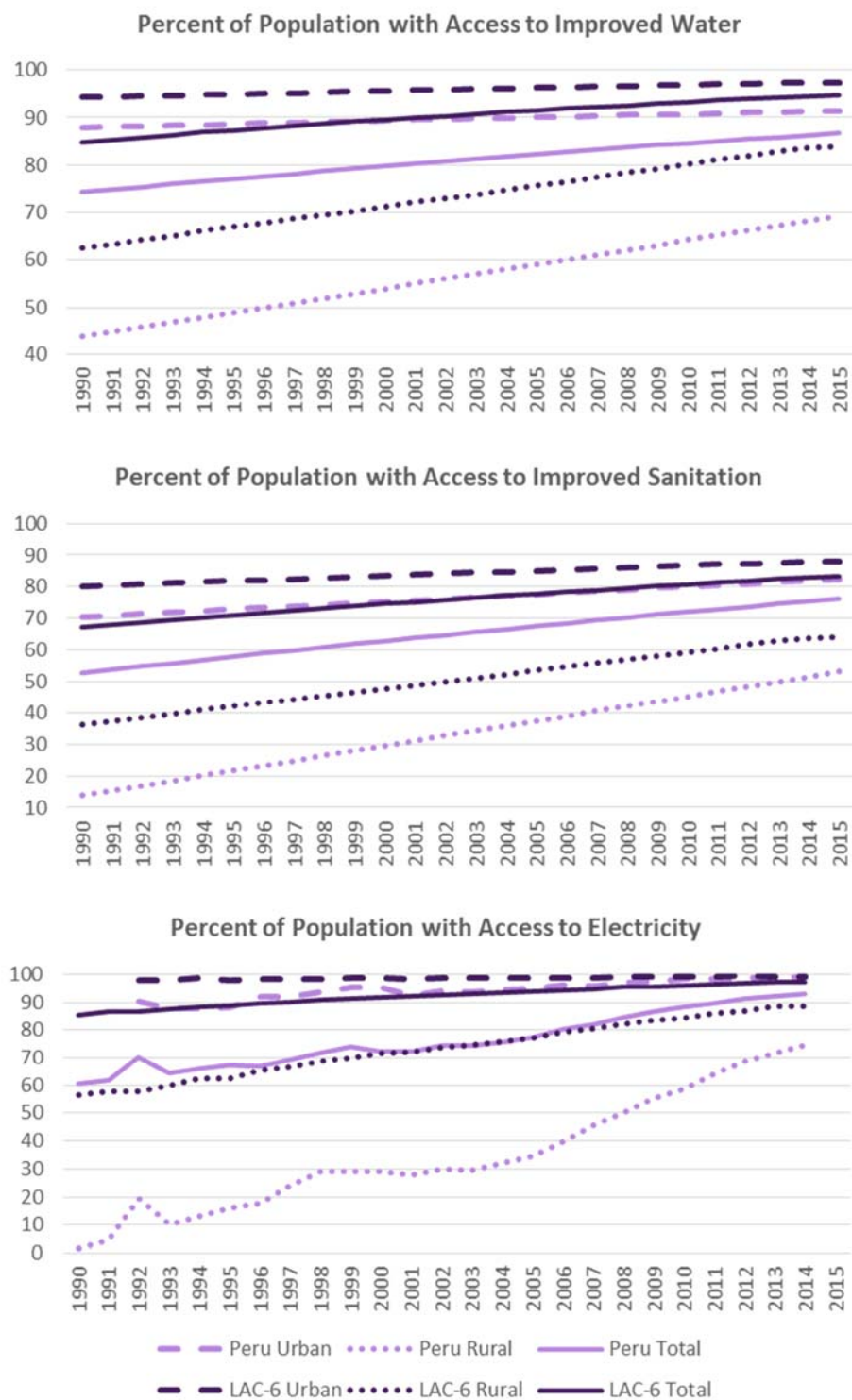
D. PERU

Figure 41. Peru: WEF Infrastructure Quality Indicators, 2007–2017²¹¹



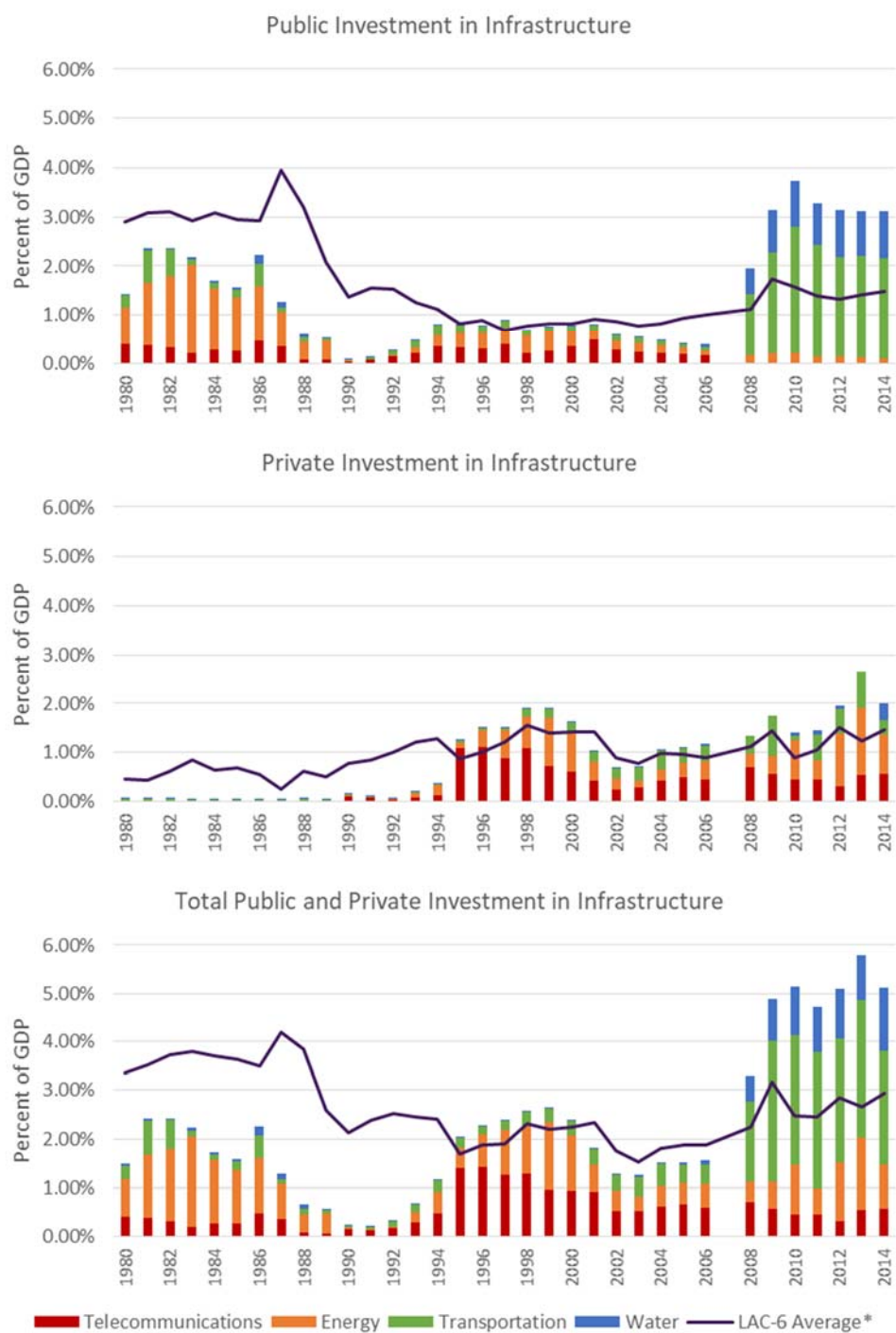
²¹¹ Adapted from WEF GCI Dataset 2006–2017.

Figure 42. Peru: Infrastructure Access Indicators, 1990–2015²¹²



²¹² Adapted from World Bank, World Development Indicators.

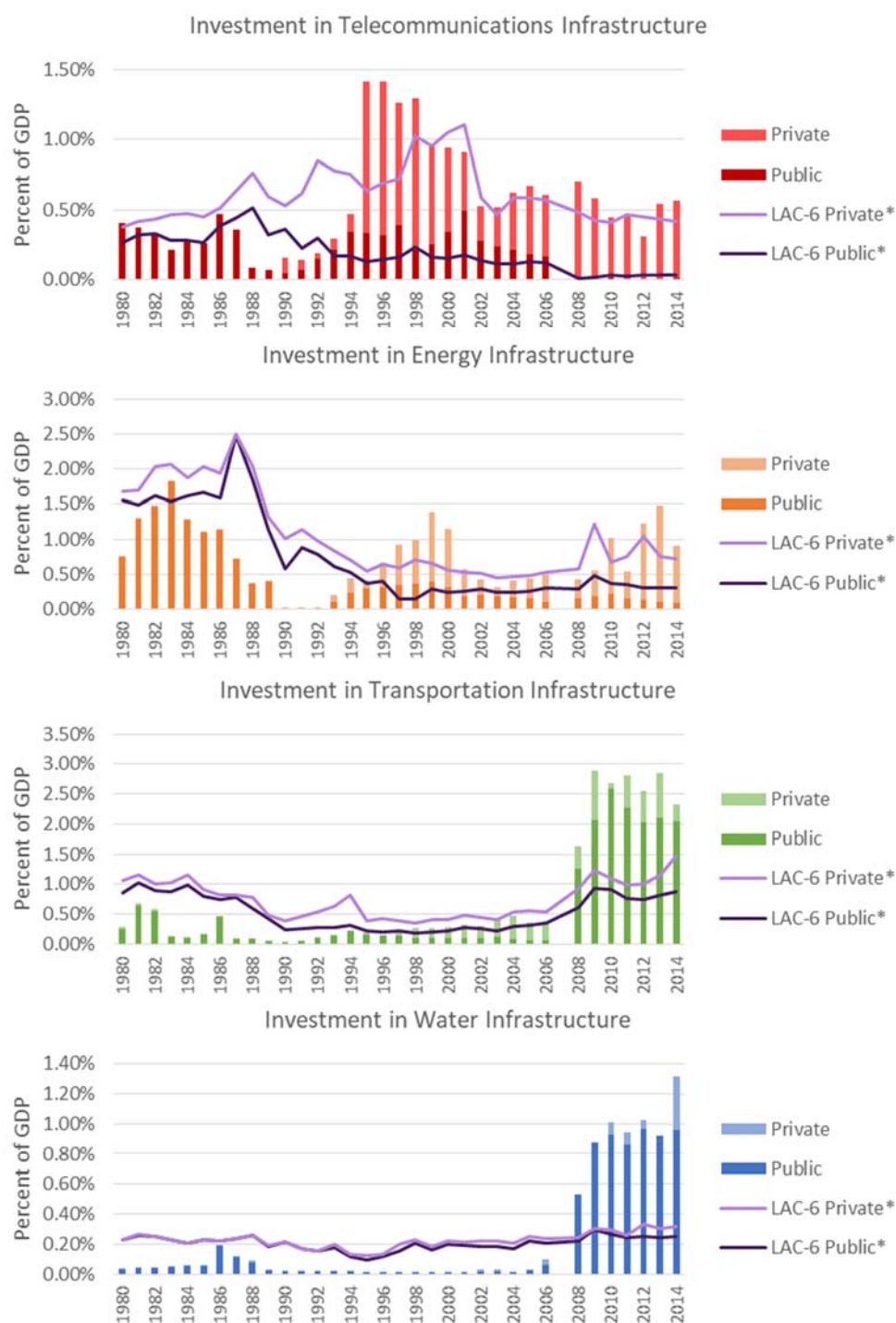
Figure 43. Peru: Public and Private Investment in Infrastructure, 1980–2014²¹³



*GDP-weighted average. 2007 data not available.

²¹³ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralataam Database.

Figure 44. Peru: Infrastructure Investment by Sector, 1980–2014²¹⁴



*GDP-weighted average. 2007 data not available.

²¹⁴ Adapted from Calderón and Servén, “Infrastructure in Latin America” and Infralatam Database.

APPENDIX B. DATA SOURCES

- Corruption perception ranking comes from the Transparency International 2016 Corruption Perception Index (CPI): https://www.transparency.org/news/feature/corruption_perceptions_index_2016.
- Fixed broadband subscriptions (per 100 people) come from the World Bank WDI: <https://data.worldbank.org/indicator/IT.NET.BBND.P2>.
- Foreign Direct Investment (FDI) net inflows as a percentage of GDP for 2016 come from the World Bank World Development Indicators (WDI): <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD>.
- GDP for 2016 in current USD comes from the World Bank WDI: <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>.
- GDP growth for 2016 comes from the World Bank WDI: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>.
- GDP per capita for 2016 in current USD comes from the World Bank WDI: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>.
- GINI index 2014 estimates come from the World Bank WDI: <https://data.worldbank.org/indicator/SI.POV.GINI>.
- Human development ranking comes from the United Nations Development Program (UNDP) 2015 Human Development Index (HDI): <http://hdr.undp.org/en/data>.
- Individuals using the Internet (% of population) come from the World Bank WDI: <https://data.worldbank.org/indicator/IT.NET.USER.ZS>.
- Infrastructure investment amounts come from both Calderón and Servén's data: <https://openknowledge.worldbank.org/bitstream/handle/10986/4003/WPS53170dataset.pdf?sequence=1&isAllowed=y>; and the Infralatam Database: <http://en.infralatam.info/dataviews/227352/infrastructure-total-sum-from-all-infrastructure-sectors/>.
- Investment in Public-Private Partnerships (PPP) since 1990 for each country comes from the World Bank PPP Knowledge Lab: https://pppknowledgelab.org/countries#latin_america_and_caribbean.
- Logistics performance ranking comes from the World Bank 2016 Logistics Performance Index (LPI): <http://lpi.worldbank.org/>.
- Rural Access Index comes from the World Bank: <https://data.worldbank.org/data-catalog/rural-access-index>.

WEF rankings of “Competitiveness,” “Institutions,” and “Quality of Overall Infrastructure” come from the 2017–2018 Global Competitiveness Report (GCR): <http://reports.weforum.org/global-competitiveness-index/>.

WEF GCI Dataset 2006–2017: <https://www.kaggle.com/weforum/global-competitiveness/data>.

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